

**CAPTAIN SULLENBERGER NAMES *HIS* HERO** p.11

# AIR & SPACE

Smithsonian

## Name It- He Flew It

**TV's First  
Eye in the Sky**

**12 TIPS  
TAKE  
AIRSHOW  
PHOTOS LIKE  
THE PROS**

**Last Living  
Pilots of  
the Spanish  
Civil War**

**Elon Musk's  
New Rocket**

Robert "Hoot"  
Gibson and one  
of his 108 rides

MAY 2009



# The Curse of the Perfect Gift

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It happened on our last trip to South America. After visiting the "Lost City" of Machu Picchu in Peru, we ventured through the mountains and down the Amazon into Brazil. In an old village we met a merchant with an impressive collection of spectacular, iridescent emeralds. Each gem was tumbled smooth and glistened like a perfect rain forest dew drop. But the price was so unbelievable, I was sure our interpreter had made a mistake.

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pink peace offering that's guaranteed to get you off the sofa and back into the bedroom in no time. Our elegant lab-created **Apology Stone Ring** features a stunning 4  $\frac{3}{4}$  carats worth of "forgiveness," specifically designed to bring out her mercy and compassion.

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**When "I'm Sorry" isn't enough.** My wife and I have been together for more than 20 years, so I've learned from experience. I only have two kinds of guy friends: those who know how to apologize and those who got divorced.

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**Stauer Apology Stone Ring**

~~\$199~~ (4  $\frac{3}{4}$  ctw)

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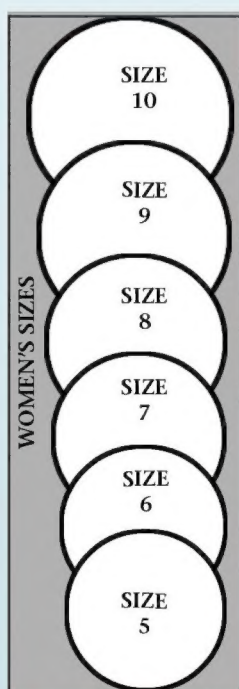
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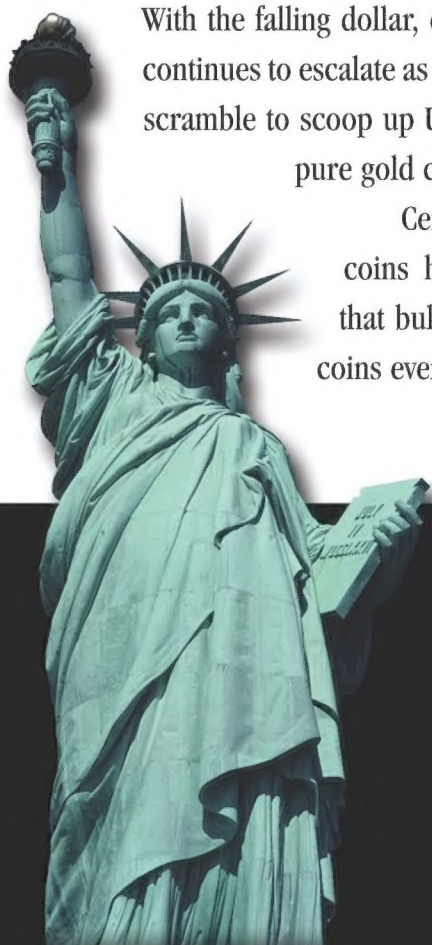
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# AIR & SPACE

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**ON THE COVER:** Space shuttle commander, Southwest Airlines captain, Reno racer, joy rider, fighter jock, experimental aircraft owner, test pilot – Hoot Gibson is “The Man Who’s Flown Everything,” p. 38. Portrait with *Enterprise* in the Steven F. Udvar-Hazy Center by Dane Penland.



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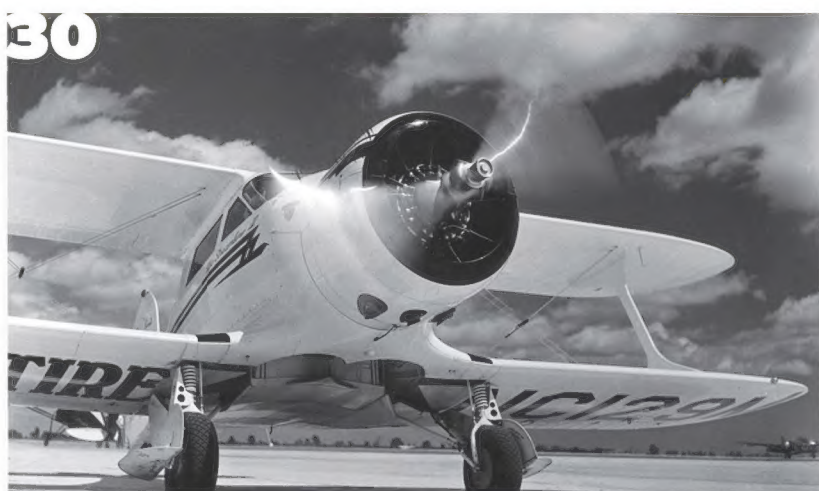


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### On the Web Site [www.airspacemag.com](http://www.airspacemag.com)

See “The Art of War,” a gallery of paintings from a new book showcasing work by Tom Lea, *Life* magazine’s artist-correspondent during World War II. Also: Watch video from the cockpit of the EA-6B Prowler, the descendant of the Grumman A-6.





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## A Battle for Hearts and Minds

**WHEN THE FEATURE FILM** *Night at the Museum: Battle of the Smithsonian* opens in theaters this May, moviegoers will see scenes that were filmed in the National Air and Space Museum. The artifacts in those scenes, however, behave a little differently from the ones we see every day. (I don't want to give anything away, but I think it's safe to say that the Wright *Flyer* was never capable of doing what it appears to do in the movie.) The artifacts have been transformed by imagination, and I think it's great.

We at the Museum recognize that we're competing for visitors' leisure time, and we know that if we are to win that competition, the education we offer has to include a little entertainment. *Night at the Museum* and another sequel, *Transformers: Revenge of the Fallen*—also filmed partly in our Museum, and opening this June—help us do that. We're hoping the movies will make people curious about the real artifacts. And we're very good at satisfying curiosity.

While there's no doubt that 20th Century Fox uses artistic license in creating an adventure in the Smithsonian, the studio got at least one thing exactly right: Airplanes are exciting. As a matter of fact, one of the airplanes appearing in the movie, the Lockheed Vega, has a backstory with as much adventure as the movie plot.

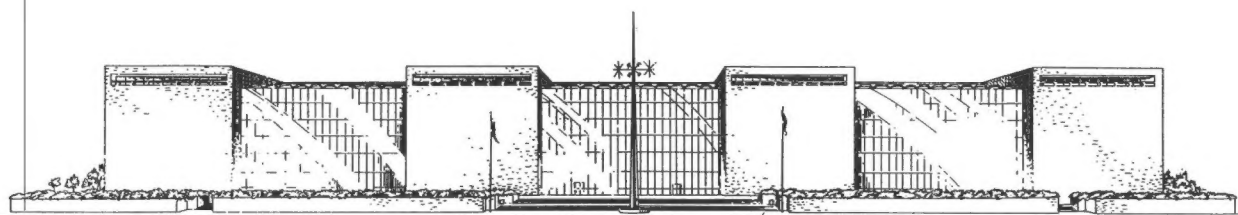
Flying that very airplane in May 1932, Amelia Earhart became the first woman pilot to cross the Atlantic Ocean alone. A few months later, she took it up again on the first solo flight by a woman

across the United States. A fast little monoplane in an era of biplanes, the Vega was a real performer. It had such long range and could fly at such high altitudes that everybody who wanted to set a record used it. Wiley Post flew one around the world; we have his *Winnie Mae* at the Steven F. Udvar-Hazy Center in Virginia. If you come to see Earhart's Vega in the Museum on the National Mall, you'll see why it got picked for the movie: Bright red and beautiful, it has star quality. And it inspired one of today's greatest pilots to pursue a career in aviation.

Airshow performer Patty Wagstaff told me that when she visited the Museum with her parents as a young girl, she let them know she wanted to be a pilot. Her mom said to her, "Patty, girls don't fly." But she saw the red Lockheed that Amelia Earhart flew across the ocean and across the country and thought, "If that girl could...." A few years later she became the U.S. national aerobatic champion. She won the title three years in a row.

When you visit the National Air and Space Museum this summer, go to the Welcome Center, and volunteers there will tell you how to find the Vega and the other artifacts appearing in *Night at the Museum*. You may not have the same type of adventure that actors Ben Stiller and Amy Adams have in the movie (and believe me, that's a good thing), but there is no doubt that adventure awaits you at the Smithsonian museums—and inspiration too.

■ ■ ■ J.R. DAILEY IS THE DIRECTOR OF THE NATIONAL AIR AND SPACE MUSEUM.







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# Letters

## WRITE TO US

### Gunslinger Reunion

In "Shooting Up a Shooting Star" (Above & Beyond, Feb./Mar. 2009) Joe D'Amario recounts that his F-80's wingtip fuel tank would neither feed nor jettison, so he opened the canopy and shot the tank full of holes to drain it and reduce its weight. That was not a first.

On May 13, 1952, while assigned to the 80th Fighter-Bomber Squadron, K-13, based at Suwon, Korea, I was flying F-80 no. 649 and experienced the same problem. I took the same corrective action.

The writer and I might have something else in common. My flight logbook indicates that on June 17, 1952, I gave an orientation checkout flight in T-33 no. 963 to a "Lieutenant D'Amario." It's possible that this was your writer.

Sid Yahn  
via e-mail

*The author replies: Sid, it sure sounds like I am the guy to whom you gave that orientation flight. The date you mentioned is about the time I was settling in at K-13. I had not heard that you too had successfully shot up a tip tank, but*

*welcome to the club. One of my pilot training classmates and fellow pilots at K-13 said that he also tried to shoot an errant tip tank. He said he stuck his pistol out too far and it got caught in the slipstream. In an effort to hold on to it, he squeezed so hard that he pulled the trigger and emptied the magazine into empty space.*

### Phantom Low-Down

In "Where Have All the Phantoms Gone?" (Dec. 2008/Jan. 2009), one caption states that an F-4H set a low-altitude speed record that is "unbroken today." I enclose a copy of the certificate [below] indicating the correct present record holder.

Darryl Greenamyer  
Indio, California

*Editors' reply: We regret the error, which was ours, not the article writer's.*

We Navy guys also took an occasional swing at the drone F-4s. During operational testing of the C-model Phoenix missile in 1983, I was in the back seat of "Vandy 33," an



**After 16 years, the F-4's low-altitude speed record was toppled by Darryl Greenamyer, flying his Red Baron, an F-104 he assembled from old parts.**



## Letters

F-14, over the desert near China Lake, California. Our job was to set up a beak-to-beak look-down pass with a QF-4 and fire our 100-mile Phoenix (which we called the “Buffalo”) at around seven miles, close enough for a real bad guy to see it in his windscreen, break-turn, and try to defeat the missile. That was the idea anyway.

We hit the numbers and lobbed the Buffalo, and right on cue the ground operator (whose name was Harlan) wrapped the QF-4 into a 7-G turn. It didn’t help. I can still hear the radio call “You’re hit, Harlan!” as the warhead detonated on the belly side, blowing off one wing and causing a violent snap roll that literally

torqued the Phantom’s tail off. I loved the F-4 but confess great satisfaction in seeing that flaming hulk spinning to the dirt. Real airplanes, big missile, live warhead, smoking wreckage: It was great sport!

Bill Mnich  
Bellevue, Washington

The article did not mention the Phantom’s final battle for the United States: during the 1991 first Gulf war. At George Air Force Base in California, I watched F-4Gs deploy fully loaded for the Gulf. When the air war started, I learned that those Wild Weasels were leading the way.

Chief Master Sgt. Jerome T. Czeikus  
U.S. Air Force (ret.)  
via e-mail

Your article recounts that Navy test pilot J.L. Felsman was killed when his Phantom crashed during a 1961 low-altitude speed record attempt. I went to school with Kirk Felsman, Commander Felsman’s son. At the time, we were in sixth grade here in Albuquerque. A few weeks before

Commander Felsman was killed, he came to our elementary school for show-and-tell and showed us his helmet and some of the equipment he used when flying the Phantom. He also showed us a photo of it, and I thought it was the most beautiful plane I had ever seen (besides the P-51 Mustang).

I also remember that the day after Commander Felsman was killed, Kirk came to class. I asked him why he hadn’t stayed home with his family, and he said that his dad would have wanted him staying in school. I’ve never forgotten that.

Carl W. Parker  
via e-mail



**With our letter writer in the back seat, this F-14 fired a Phoenix missile (background) that took out a QF-4 drone in 1983.**

## Lindbergh Crashed Here

“You’ve Got Mailplanes” (Dec. 2008/ Jan. 2009) mentions that on September 16, 1926, Charles Lindbergh crashed a Robertson DH-4 on an Ottawa, Illinois farm, and that one piece of mail from that flight has turned up. That envelope was owned by my father-in-law, Bud Upshur, now 90. (He recently sold it.)

After I discovered that the envelope was from that crash, I called the city of Ottawa and was given the number of the farmer’s grandson. He has a number of artifacts from the crash (goggles, airplane parts). He e-mailed photos of the crash and of Lindbergh.

Charles Craciun  
via e-mail

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## Letters

### But Is It "Flight"?

Not to belittle Scaled Composite's tremendous accomplishments, but isn't calling *SpaceShipOne's* four or five minutes of weightlessness "spaceflight" like calling a Sea World dolphin's leap into the air "flying" ("License to Thrill," Feb./Mar. 2009)? In neither case is there any controlled maneuvering or long operation in the medium.

John MacDonald  
Missoula, Montana

### The Mexican Cousin

"Bring Back the Brute" (Feb./Mar. 2009) says that no original Gee Bee R-1 or R-2 exists. I saw a Granville racer in the city of Lerdo, in Durango, Mexico. The racer, once flown by Jacqueline Cochran, was sold to Mexican pilot Francisco Sarabia in 1938. The following year, Sarabia set a Mexico City–New York City speed record in it. On the return flight, the engine choked after takeoff and Sarabia crashed in the Potomac River and drowned. The airplane was transported to Lerdo, where it was placed on exhibit in a museum.

Ernesto Xavier Gutierrez  
via e-mail

*Editors' reply: That racer is indeed a Granville, but an R-6, not an R-1 or R-2.*

### Wait a Second...

At one point, "One More Second" (Dec. 2008/Jan. 2009) says: "Over the past 200 years, the length of the day has increased by only 0.0025 second." The article also states "leap seconds have

generally been added every year or two" and reports that some suggest making a change "only every 600 to 900 years, by inserting a full hour instead."

I can't make those numbers add up.  
James S. Bomgardner  
Ellicott City, Maryland

*Editors' reply: Some mistake leap seconds for a measure of the rate at which Earth is slowing. The one-second increments are actually a measure of the accumulated difference in time between two systems: our timekeeping and Earth's rotation. The rate at which the two systems depart from each other continues to increase, so it will be necessary to increase the corrections continually over time.*

### Another Floater

"Hope Floats" (Soundings, Feb./Mar. 2009) sums up some new sea- and floatplane designs. Another company, Quest Aircraft, is making an aircraft, the Kodiak, with the option for floats.

John Martin  
via e-mail

### Corrections

*Feb./Mar. 2009 "Woe Canada": The company that made the Meteor was Gloster, not Gloucester.*

*"Supersonic Sales Call": The problem Craig Penrice experienced before a flight was with the inertial platform flight control computers use for attitude reference, not with the inertial guidance system.*

*Reviews & Previews, Planetology review: Tom Jones flew on four, not two, shuttle missions.*

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# Soundings

NEW IDEAS, ODDBALL EFFORTS, STRIDES AND MISSTEPS



MYTH MERCHANT FILMS

## The Shape of Early Stealth?

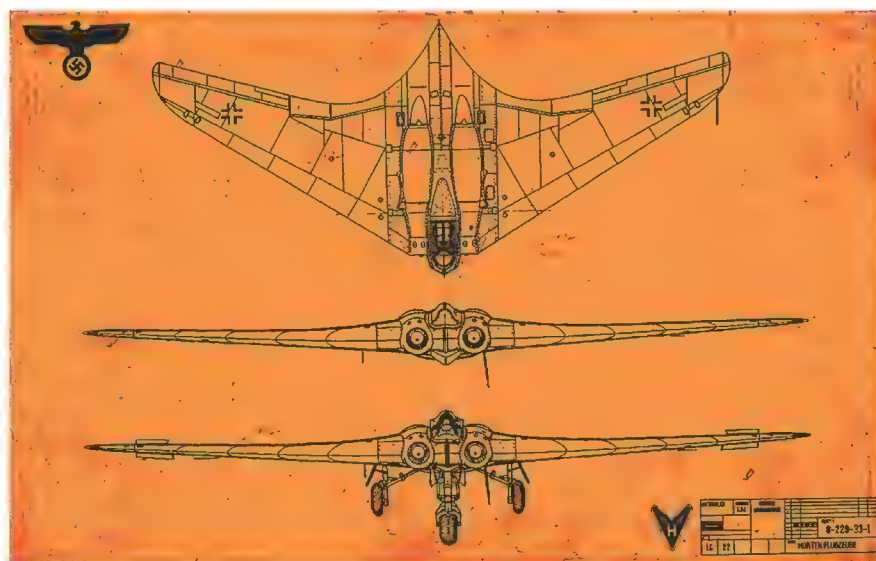
**>>> AN AEROSPACE** company rarely spends time building old designs, but last September, the stealthmasters at Northrop Grumman, builder of the B-2 Spirit bomber, began to revive a flying wing design from the 1940s. As a filmmaker who has made documentaries about the U.S. aerospace industry, I wanted to record the company's effort to construct a full-scale, 55-foot-wingspan replica of the Horten flying wing.

The advanced aircraft projects of Hitler's Nazi regime have long fascinated aviation enthusiasts, perhaps none more than an aircraft that closely resembles the

modern B-2 flying wing—which in turn takes after the Northrop flying wing of the late 1940s.

Conceived by Walter and Reimar Horten, the all-wood, jet-powered Ho 229 first flew in December 1944. Luftwaffe head Hermann Goering ordered an entire squadron of 229s to be built under the Emergency Fighter Program. Though World War II ended before the aircraft could enter service, its stealthy shape has led many to wonder if the fighter might have been able to evade detection by Allied radar systems.

"It's a chance to get some accurate data on the 229 and answer one of the



ARTHUR BENTLEY

last great mysteries of World War II," says project lead Tom Dobrenz. When the model builders completed construction at the company's El Segundo, California facility, the replica moved to the Tejon facility in the Mojave Desert. Using period radar that the Ho 229 would have flown against in combat, the Northrop Grumman team will determine just how stealthy the fighter was.

**The Horten takes center stage (top) in a new film. Horten specialist and artist Arthur Bentley did the 3-view.**

My film, the Myth Merchant Films documentary *Hitler's Stealth Fighter*, will air on the National Geographic Channel at 9 p.m. ET on June 28 in the United States; in Canada, the program will air on History Canada.

**MICHAEL JORGENSEN**



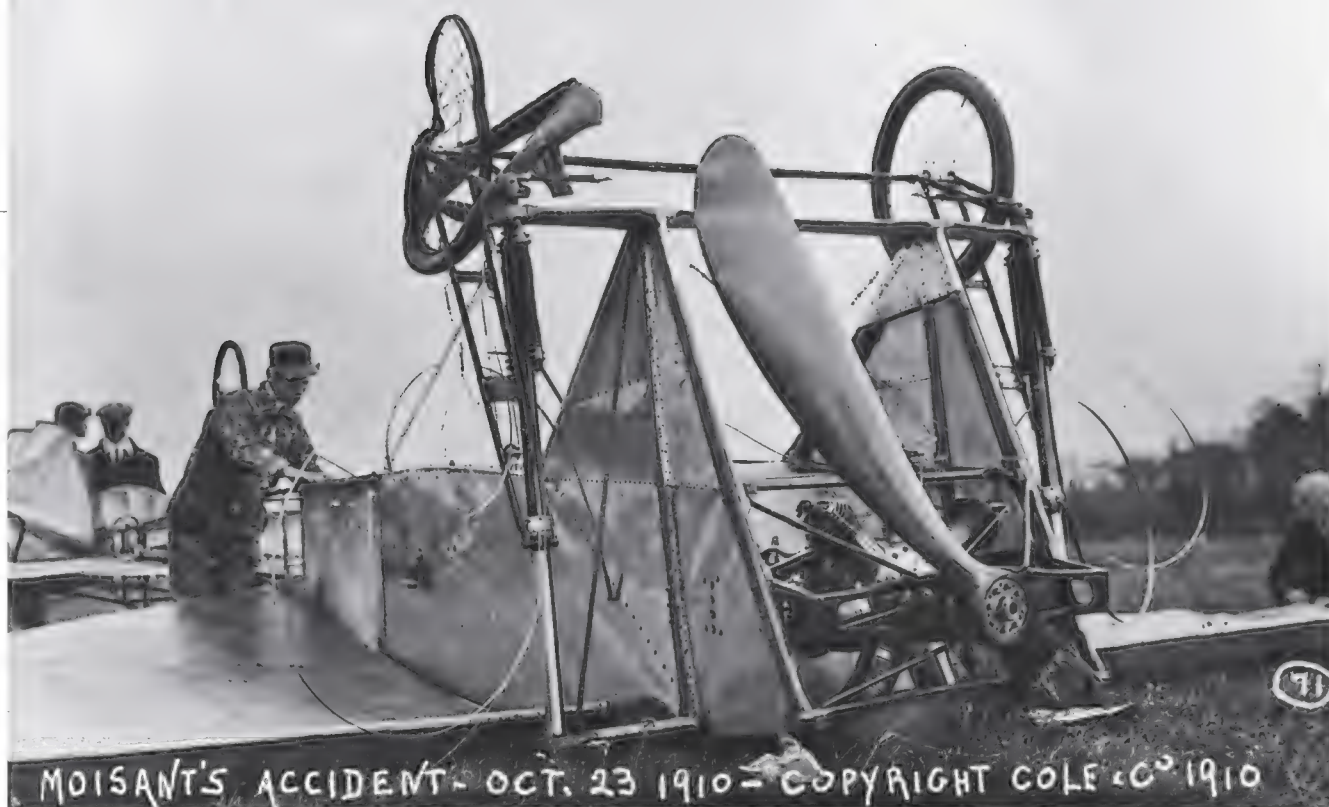
## Bladeruiner

»» WILLIAM HAVENER is looking for a few bad pilots.

Not *that* bad, though. Just incautious enough to have bent a propeller once. Or maybe, like Havener, twice.

Like the old chestnut about there being two types of pilots—those who have landed gear-up and those who will—the same goes for bending a prop. To bring the benders together, Havener has formed the Benevolent Order of Bended Blades. He was inspired by the misadventure of a friend. In 1978, Jack Kromer was briskly taxiing a Piper Vagabond on a snowy Illinois airstrip when the aircraft's balloon tires plowed into “deeper, sticky snow” and the aircraft abruptly nosed over. “The Vagabond was sitting in a patch of snow in a three-point attitude,” Havener says, “but the wrong end of the airplane was resting on the ground. About an inch of each prop tip curled back. The tips looked so uniform that had I not known better I could have believed they were intended to be that shape.”

Havener figured there



should be a way to recognize those who have pranged a propeller—without injuring anyone. “Jack had just done it,” he says. “I had done it in the distant past—twice. I knew others had done it.” As of 2008, the Order had 68 members, “not only in the U.S. but also in Canada, Australia, and Tasmania,” says Havener, holder of certificate no. 1 (Kromer holds no. 2).

“It’s strictly a fun thing, with no desire to

accomplish anything other than to get people to swallow their pride and admit what they did,” he says. “There are no plans to have annual get-togethers, but it probably would be fun to get a bunch of prop prangers together to hear their stories.” Each member receives a certificate commemorating his or her baptism by blade-bending.

Says Havener, “Since I am not on the Internet, we must rely on the U.S. Postal Service.” Send your name,

**John Moisant, early prop-pranger, failed to send an application to the Benevolent Order of Bended Blades.**

address, date of incident, and type of aircraft pranged to William Havener, 1409 Sixth Avenue, Sterling, IL, 61081-2541. Although there are no membership fees or dues, “five dollars to cover the ever-increasing costs of printing and mailing would be greatly appreciated,” he adds.

 PATRICIA TRENNER

### WORK IN PROGRESS

## Soon To Be Super Again

**LUFTHANSA'S** foundation for historic aircraft, Deutsche Lufthansa Berlin-Stiftung, has bought three Lockheed L-1649A Super Constellations from Maurice Roundy, a Maine-based aircraft enthusiast, and recently set to work restoring one. The long-haul Super Constellation was the last major piston-engine airliner to debut. During the late 1950s, Lockheed built just a few dozen:

TWA bought 29; Air France, 10, and Lufthansa, four. Lufthansa says that today, only four are preserved; none is airworthy.

No. N7316C had been configured for cargo; the restoration will turn it into a luxurious airliner, and upgrade the cockpit with the latest technology. Former Lufthansa aircraft mechanics who once worked on L-1649As will join Lufthansa Technik mechanics and engineers from Germany to carry out the restoration in a hangar in Auburn, Maine. Completion is scheduled for 2011, and then the Constellation will join the foundation's fleet – a Messerschmitt Me 108 Taifun, a

Dornier Do 27, and a Junkers Ju 52/3m – in Germany, where flights in the vintage aircraft are highly prized.

**Lufthansa will give three workhorse Constellations a good home.**



LUFTHANSA



## Infrared Twofer

**>>> THOUGH NOT** the flashiest parts of the sky, the giga-acre stretches of cold wasteland between stars have lately taught astronomers a lot about the cosmos. Now a tag team of orbiting telescopes, both set to launch on the same European Space Agency rocket in mid-April, will dramatically expand the range of deep-space signals scientists can monitor.

The telescopes, named Herschel and Planck, have complementary missions. Herschel is the largest telescope ever launched into space (its primary

mirror spans 11 feet) and will collect long-wavelength infrared radiation—basically heat from clouds of space dust.

“We’re looking at how an interstellar cloud decides, ‘Well, today I’m going to decide to make stars,’” says ESA project scientist Göran Pilbratt, who has worked on Herschel since 1991. The team also hopes to study comets, astrochemistry, and why galaxies formed more readily billions of years ago.

Herschel, named for

astronomer William Herschel, who discovered Uranus, resembles a throne with the Stanley Cup in its seat. The back of the throne will cloak the telescope from the infrared radiation that Earth, the sun, and the moon constantly pump into space. The columnar “cup” houses the huge telescope and a liquid-helium cryostat that will keep Herschel at a super-cold –456 Fahrenheit. At higher temperatures, the heat from Herschel’s own instruments would

**Stars in the Andromeda galaxy, wrapped in envelopes of dust, light up in infrared.**

overwhelm its readings.

The Planck telescope, named for German physicist Max Planck, who first conceived quantum theory, will collect even colder infrared radiation. Its squat cylinder base and searchlight crown will spin and absorb light from all portions of the sky. Its aching slow pace—two revolutions over 15 months—will allow Planck



NASA/JPL-CALTECH/K. GORDON (UNIV. OF ARIZONA)

## Radar, UAVs, and Border Collies

**>>> ON AN AUGUST** day in 1995, Israeli pilot Ronen Lev and navigator Yaron Vivente were rocketing 1,000 feet over the Negev Desert in a McDonnell Douglas F-15 when three white storks hit their fighter. Two struck the fuselage and one was ingested by the left engine. Within four seconds, the airplane rolled over and crashed, killing both air force captains.

Twice each year, Israel hosts half a billion migratory birds of 500 species. Most, small flappers, take direct overseas routes. But large, heavy, wide-winged gliders like storks and raptors spiral from one thermal to



another like sailplanes. The birds share airspace with hundreds of military and commercial aircraft, causing some 250 bird-airplane collisions a year. During migration periods, Israeli airspace has the highest concentration of birds—and fighter aircraft—in the world.

Over the years, notes Yossi Leshem, director of the International Center for the Study of Bird Migration and affiliated with Tel Aviv University, birds have

downed more Israeli airplanes than enemy aircraft or missiles. “If a 20-pound pelican hits a plane flying at 500 knots,” he says, “it impacts at 100 tons, like hitting two tanks.”

Birds will not change their routes, Leshem realized, but pilots can change their flight paths to avoid them. Starting in the early 1980s, Leshem spent hour after hour chasing thermals in a motorized glider, soaring amid flocks

**Border collies – especially those in F/A-18s – keep birds away from Israeli airports. Yossi Leshem soars with flocks to track their flight paths.**



of raptors, white storks, and pelicans to collect data on their migratory habits. He then correlated his findings with data compiled by volunteer birdwatchers, air force scanning radar at Ben Gurion International Airport that peers out 45 miles, and Israeli army intelligence unmanned aerial vehicles droning 4,000 feet over migrating flocks.

Today Leshem uses this data, fine-tuned air traffic

LEFT: COURTESY DR NICK CARTER, BCR; RIGHT: EYAL BARTOV




to map the echoes of radiation left over from the Big Bang, focusing especially on “anisotropic” regions, where the background radiation is a tad stronger or differently polarized.

Both telescopes—which together cost \$1.9 billion to build and launch—will orbit the same point 900,000 miles from Earth. Due to their long commute, it will be a few months after launch before each telescope starts sending back signals. Herschel will operate for four years, exhausting its cooling helium. Planck should operate for 15 months; it has a better chance of functioning beyond its expiration date.

 SAM KEAN

radar, and weather statistics charted by a digitized former Russian MRL-5 weather radar to create maps that pinpoint where and when particular species are expected. During the bi-annual migrations, air force squadrons consult these maps religiously, changing some air routes as needed and banning flights below 3,000 feet—the lower the airplanes, the greater chance of collisions. Civilian pilots also keep a sharp lookout, especially during takeoffs and landings. Since 1984, reports Leshem, bird-plane collisions have dropped 76 percent.

Not all bird-airplane solutions are technical. Trained border collies roam Israel's air force bases. Birds, even at higher altitudes, perceive them as predators and steer clear.

 MELODY AMSEL-ARIELI

## Chesley Sullenberger

CAPTAIN, US AIRWAYS

Last January, “Sully” Sullenberger and his crew ditched their Airbus A320 in New York's Hudson River after a collision with Canada geese took out both engines.

### ***Does the Airbus operator's manual have a procedure for ditching?***

Yes, but in this case, time would not allow [for using] it. The higher-priority procedure to follow was for the loss of both engines. The ditching would have been far secondary to that. And not only did we not have time to go to a ditching checklist, we didn't have time to finish the loss-of-thrust-in-both-engines checklist. This was a three-page checklist that we were dealing with, and we didn't finish the first page. That's how time-compressed this was.

### ***Did the airplane have a mechanism to seal certain openings in the cabin?***

Yes, a ditching push button. We never got to it; it wouldn't have mattered anyway. I cannot conceive of any ditching or water landing where it would help. It sounded like a good idea, but not in practice. The vents that are normally open are small. We had a successful water landing and even then, the bottom of the airplane in the back – from seeing the pictures of it being removed from the river by a crane – [the landing created] much larger holes than the vents this button was designed to close.



COURTESY CHESLEY SULLENBERGER

**Chesley Sullenberger in an MD-80 in 2001, with daughters Kate (left) and Kelly.**

as smooth and elegant a continuous descent as I could. You could barely feel the wheels touch.

### ***Any advice for aspiring pilots?***

My view of the world is that people are best served when they find their passion early on because we tend to be good at things we're passionate about. I think we also need to find people whom we admire and try to emulate them.

### ***And who did you admire?***

My first flight instructor, L.T. Cook Jr., was a Civilian Pilot Training Program instructor during World War II, a real gentleman and a stick-and-rudder man. He was a cropduster and had his own grass strip in rural Texas. In 1967, I paid \$6 an hour for the airplane and gas and \$3 an hour for his time. Among the thousands of cards I received [after the ditching], I discovered one from his widow. She wrote, “L.T. wouldn't be surprised, but he certainly would be pleased and proud.”

Read the entire interview at [www.airspacemag.com](http://www.airspacemag.com).



# In the Museum

STOPS ON A TOUR THROUGH AMERICA'S HANGAR

## The Bodyguard

**TROPHIES AWARDED** by the National Aeronautic Association reside at the National Air and Space Museum, where they can be kept in a controlled environment and seen by the public. They leave the Museum just once a year, for the association's awards dinner.

In the past, Museum personnel didn't accompany the trophies when they left the building. During the 1978 Collier award dinner, held at the Mayflower Hotel in Washington, D.C., someone "borrowed" the 27-inch-tall bronze top piece of the Collier trophy. After the *Washington Post* reported the theft, an anonymous caller suggested that the top could be found near a certain bush at Fort Foote, a small park near Oxon Hill, Maryland. "There's probably only about \$100 worth of bronze in the thing," NAA spokesman Vic Powell told the *New York Times*, "but it has tremendous symbolic and historical value."

To tighten up security, in 1989 the Smithsonian assigned an intern, Alex Spencer, to take responsibility for the trophies. Twenty years later, Spencer, now a curator with the Museum, continues to watch over them.

For most of the year, the trophies remain in glass cases on the Museum's first floor, but when awards time rolls around, Spencer is ready. "I



**During the 1978 Collier award dinner, held at the Mayflower Hotel, someone "borrowed" the 27-inch-tall bronze top piece of the Collier trophy. After the *Washington Post* reported the theft, an anonymous caller suggested that the top could be found near a certain bush at Fort Foote, a small park near Oxon Hill, Maryland.**

get word about two and a half months ahead of the presentation event," he says. The NAA or other sponsoring organizations will provide a loan agreement, which stipulates that Spencer accompany the trophy during the loan.

Craftspeople at the Museum's Paul E. Garber Preservation, Restoration and Storage Facility in Suitland, Maryland, built a plywood case for the two most prominent NAA trophies, the Collier

**In addition to guarding the National Air and Space Museum's treasured trophies, Alex Spencer is responsible for the British military aircraft holdings, and the 13,000 artifacts that make up the flight matériel collection.**

and the Mackay, given for advancement in aeronautics and most notable military flight, respectively. The case has special supports and blocks that mate with the trophies and stabilize them within the case. Ethofoam, a light but extremely dense foam material valued for its inertness, protects against shocks. Finally, an inert adhesive material called "quake wax" helps to maintain a firm grip on the object.

On the day of the event, Spencer opens the display case and packs up the trophy. He and an assistant load

ABOVE: ERIC LONG; OPPOSITE: DANE PENLAND



the precious cargo into a Smithsonian van and drive it to the venue where the trophy banquet will be held. Spencer unpacks the trophy on center stage and works with lighting designers to get just the right positions. "Usually there's a photo session just before the event," he says. "When the event is over, you have a crowd that will gather on stage to get pictures." Spencer keeps a close watch to ensure the revelers do no harm. "I try to keep people away from it as much as I can, to prevent them from hugging it, touching, putting drinks down on it, and that sort of thing," he says.

As soon as the partying dies down, Spencer packs the trophy back up and drives it back to the Museum, regardless of the hour. "My goal is to get there by 11 or not later than midnight," he says, after which additional Museum security kicks in. He leaves the trophy packed and locked up overnight, and the following morning, returns it to the display cases.

A few years after the Collier theft, a trophy was left at the Museum's



**Family Days** "Explore the Universe Day" takes place on April 4, during the kickoff for the International Year of Astronomy. The event, which will explore the contributions of female astronomers, will be held at the Museum on the National Mall. Admission is free; activities run from 10 a.m. to 3 p.m. On May 2, experience "Space Day: Human Space Flight, Past, Present and Future" at the Museum on the National Mall. Talk to former astronauts, build your own space models out of Legos, and more. The event runs from 10 a.m. to 3 p.m.; admission is free.



**What's Up** Receive regular updates on Museum events, read about artifacts, get detailed (and behind-the-scenes) exhibition information, and receive calendar listings, all by subscribing to the National Air and Space Museum's free monthly e-newsletter, *What's Up*. Sign up at [www.nasm.si.edu](http://www.nasm.si.edu).



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loading dock, where it sat, undiscovered, until the next morning. When Spencer took over the job, he said, "This is not the way we're gonna do

this anymore." So these days, if you borrow a trophy, you get Alex Spencer too.

■ ■ ■ GEORGE C. LARSON

## ARTIFACTS

### Howdy, Pilgrim

**THE 1925 GOODYEAR PILGRIM**, designed for company vice president P.W. Litchfield, was originally intended for pleasure cruising. The airship's small, enclosed gondola – featuring plush blue velour and mahogany – accommodated a pilot, a mechanic, and two passengers. One of the smallest airships, the *Pilgrim* was just 105 feet long and 45 feet tall; it could cruise for 500 miles at 40 mph. "Personally," reported *Flight* magazine in 1926, "we think this small 'blimp' type of airship possesses great possibilities from the sporting point of view, as is the case with ballooning – although, of course, 'blimping' comes out a trifle more expensive." Ultimately, Goodyear used the *Pilgrim* for train-



ing and demonstrations; by the time the airship was retired in 1931, it had made 4,765 flights covering some 95,000 miles.

**With its rich interior, the *Pilgrim* was advertised as America's first "air yacht" – although none were ever built for the civilian market.**



# Above & Beyond

MEMORABLE FLIGHTS AND OTHER ADVENTURES

## My Enemy, My Friend

**IN 1971, THE U.S. AIR FORCE** offered a checkout in the McDonnell F-4 to Republic F-105 drivers who had completed a 100-mission combat tour and were willing to volunteer for a second tour. I dearly loved the Thud, but with its numbers dwindling due to combat losses, its future was bleak.

I checked out in the F-4 at Homestead Air Force Base in Florida and in June arrived at Udorn Royal Thai Air Force Base in Thailand. The usual mission of the 13th Tactical Fighter Squadron was two-ship bombing flights under forward air control in Laos and an occasional reconnaissance escort into southern North Vietnam. By protecting the recon guys from MiGs, aircrews felt

they were really doing something productive and, according to the rules of engagement, if the recce airplanes were fired at, we could drop bombs.

In 1972, combat missions grew more challenging. More reconnaissance escorts were dropping bombs and more F-4s were sent on multiple-flight missions against specific North Vietnam targets. On April 15, the air tasking order for the next day called for 20 airplanes to fly MiG patrol in the Hanoi area for bombing flights taking off from other F-4 and F-105 bases. The gloves were coming off.

At 8 a.m., the four airplanes of Basco Flight, each with three external fuel tanks and less than a full load of missiles, roared off Udorn's Runway 12, with Fred Olmsted and Stu Maas leading and Jeff Feinstein and me flying number 3. We jettisoned our empty centerline tanks and accelerated across the border into North Vietnam, heading straight for Hanoi. Enemy surface-to-air missile radars were on us immediately but we ignored the warnings: Our mission was to kill MiGs.

From the back seat of Basco Lead, Maas radioed that he'd spotted MiGs: two "bandits" dead ahead at 20 miles. We jettisoned our inboard fuel tanks,

lit afterburners, and set switches as two MiG-21s tracked down the radar screen. Olmsted gained visual contact on the silver fighters as they passed overhead. We made a hard right turn to get into firing position.

Out of nowhere came a camouflaged MiG trailing the first two. I rolled out of the turn and headed straight for him, following as he broke into a cloud bank. "Lock him up, he should be right off our nose," I told Feinstein. But we were unable to lock on in the clouds, with surface-to-air radar warning blasting in our ears, so I pulled up into the clear. Flying with no visibility in a high-threat area is not what you want to be doing, MiG or no MiG.

Basco 4, Greg Crane, was hanging in there just fine as we popped out in the clear on top of the clouds. Then he spotted our MiG at 2 o'clock high. We made a hard climbing turn into firing position. Fire one Sidewinder. Fire two. No results. Something was wrong with my fire control system.

Frustrated, breathing hard, I switched element lead with Crane, who, in a descending right turn, fired three AIM 7 Sparrow missiles. Nothing. *Are we snake-bit, or what?* I took the lead again.

I concentrated on smoothly tracking the MiG in my gunsight and setting up switches for a shot. Lo and behold, at about 4,000 feet Feinstein got a full system lock-on. I clamped down on the trigger—with no expectations—and *swoosh*, out came a Sparrow. It hit the MiG in the right wing root. The wing blew off. Flame, smoke, and pieces of airplane went in all directions. What remained of the aircraft went into a snap roll and then, right in front of me, out popped the pilot with his parachute. I had to maneuver quickly to avoid the white canopy with one red panel. Crane



**Major Dan Cherry (above) and Lieutenant Hong My (right) first met in the skies over North Vietnam on April 16, 1972...**



LEFT: COURTESY DAN CHERRY; RIGHT: COURTESY NGUYEN HONG MY



confirmed the kill, and we joined up and headed home. Then came Olmsted's call, "Scratch another MiG-21," confirming his kill on one of the silver MiGs.

Two confirmed MiG kills, and all of Basco Flight coming home safe and sound. The Udorn Officers Club was the hot spot that night.

**IN JUNE 2004**, during a visit to the National Museum of the United States Air Force in Dayton, Ohio, some friends and I discovered the very airplane I had flown that April day 32 years ago. F-4D no. 66-7550 was on static display on the outskirts of Dayton, with my name and the red victory star, but the elements had taken their toll. Citizens in my hometown, Bowling Green, Kentucky, working to establish an aviation museum there, arranged to borrow Phantom 550 for future restoration and display.

We constantly brainstormed ways to promote Aviation Heritage Park and raise money to acquire more aircraft. The idea of trying to find the MiG pilot came up, usually over a couple of beers, and in jest. Still, I had always been curious about his fate—who he was, whether he survived, if he had a family—so we set about seeing what we could find out.

Through an acquaintance, I learned about a Vietnamese television show, "The Separation Never Seems to Have Existed," which reunites people who have lost touch. When the producer heard of my quest, she asked me, via e-mail, to write a letter stating my intentions and the circumstances surrounding the dogfight. Within two weeks she had found the MiG pilot, and invited me to Vietnam to appear on television with him.

On April 5, 2008, on live television, my heart pounded as Nguyen Hong My—the man I had last seen in a black flightsuit, swinging under a red and white canopy—walked onto the set. He greeted me with a firm handshake and words of welcome, and expressed his desire for us to become friends. We sat down at a table with the producer, Thu Uyen. The interview began with our



JOHN FLECK

histories and pictures of our families. I teared up when I saw photos of our children and grandchildren on the monitor, and so did Hong My—two tough old fighter pilots weeping on national television.

After the show, we had dinner and wine on the roof of the Majestic Hotel in Ho Chi Minh City, and with the help of an interpreter, we got to know each other. In the early 1960s, Hong My spent four years in the Soviet Union, training to fly and checking out in the MiG-21. He told me that Ho Chi Minh himself had presented him with his pilot wings and that he had been credited with one American shootdown. In our engagement, he broke both arms and severely injured his back in the ejection, but he recovered and went on to fly for two more years.

Hong My then invited me to his home in Hanoi. I had already planned to fly to Hanoi the next day, so he changed his airline reservation to fly with me. With my former adversary by my side, we flew over the same countryside where I had flown so many combat missions.

After I checked into my hotel we walked to Hong My's home through the streets of Hanoi, passing the beautiful old French Opera House and dodging motor scooters. I was introduced to his son, Quan, his wife, Giang, and grandson, Duc, who was celebrating his first birthday. Hong My was holding Duc, and as I came close, the little boy reached out to me. And then, Hong My placed Duc in my arms. I couldn't help thinking that had

**...and again, 36 years later, on a most extraordinary mission.**

things gone differently in the sky that day 36 years ago, Duc wouldn't have been here for me to hold.

After a wonderful Vietnamese dinner, Hong My offered to take me back to the hotel on his motor scooter. (Everyone in Vietnam has a scooter.) We zipped through the streets of Hanoi, the MiG pilot and the F-4 pilot, laughing, dodging traffic, and having a grand old time.

The next day, Hong My was my tour guide. We went to every museum, war memorial, and tourist attraction, including the "Hanoi Hilton." Hoa Lo Prison, now a museum, was built by the French at the turn of the century, when Vietnam was a French colony. Most of the exhibits are about the French imprisoning Vietnamese citizens who had fought for independence, but a few showed American POWs during their incarcerations.

Usually gregarious and outgoing, Hong My turned quiet and somber. As I studied photographs of American POWs, he whispered, "Did you have friends in here?" I pointed to a picture of Colonel John Flynn. "He is my friend." Hong My lowered his eyes and shook his head.

As we emerged, I was overwhelmed with sorrow. Hong My put his arm consolingly around my shoulder and patted me on the back. On the street in front of the infamous POW jail, my enemy had become a true friend.

DAN CHERRY



# Flights & Fancy

WHIMSY, NOSTALGIA, AND JUST PLAIN MISCHIEF

## Homage

**IN 1976, AS A STUDENT PILOT** at Palwaukee Airport, north of Chicago, I got the instructor that all the junior birdmen were dying to get.

Fred W. Porps *looked* like a Fred W. Porps: five-foot-five in his stocking feet, adorably bald, with the physique of the Pillsbury Doughboy. But looks can deceive. Fred could bench-press a Chevy Monza, swim—or at least float—for hours, and fire an M1 and hit an aspirin tablet at a hundred yards. He was a licensed electrician, carpenter, and plumber, beekeeper, and welder. He could build a house in six months and rebuild a Studebaker in six days. His kites

do before being allowed to vote.

Fred assumed that you, the student, were as smart, skilled, motivated, clever, and gifted as he was (something of a stretch in my case). He didn't leave you down at the level of a student pilot; he raised you up to the level of a Fred Porps. Were you having trouble with takeoffs? Landings? Steep turns? He knew that sooner or later it would all come together for you, and if it was taking you longer to learn the

lousy that the controllers in the tower couldn't tell if any airplanes had made it in, let alone how many. We landed, taxied back to the ramp without a word to ground control, shut down the engine, and then collapsed in each other's arms, alive and illegal instead of legal and dead.

Fred took to unloved facts the way women take in stray kittens. Do you know how many ping-pong balls a standard toilet should be able to flush? Do you know how to fix a slot machine? Fred did. How do you put in bay windows? How many liters to a gallon? How do you hot-wire a Lamborghini? Ask Fred.

With Fred, there were only interesting problems requiring interesting solutions. Could a mere airline pilot or brain surgeon or philosophy professor have invented a Porps-O-Phone, let alone build one? A Porps-O-Phone was a battery-operated doorbell linked to the inclinometer on a turn coordinator with limit switches. Every time you skidded in a turn you were informed of your malfeasance by a doorbell going off in the cockpit.

Fred gave to all who flew with him something much more than flight training. He gave them an example of a fully engaged human being working at the peak of his capabilities. To be with Fred was to want to be like him in some way, no matter how small, because he found everything in the world so very interesting, and deep down inside, that part of you untouched by cynicism realized intuitively that interesting was a very good way to view the world.

I showed this remembrance to my wife, and she said, "You make it sound like he's dead." So I called Fred to ask if he'd like to read his obituary. His reply? "Not yet."

PETER M. CLELAND



flew higher, his potato cannons shot farther, and his solar-powered cigarette lighters worked better than anyone else's in the county. And he was a certificated flight instructor.

Fred didn't put much stock in lesson plans. He didn't put much stock in lessons. He put a lot of stock in doing things that interested him, and if quite a few of these involved flying, so much the better. To Fred, flying was something that, like welding, every American citizen should know how to

automatic direction finder than it had taken him, that was undoubtedly because you saw in that wretched instrument some fascinating complexity that he had missed.

I remember coming back into Palwaukee one afternoon in a no-gyro, no-nothing beater Cessna 150 as the weather slid from good to bad to awful. Fred solved the problem of staying alive by piggybacking onto another guy's air traffic control clearance to land. He knew that the weather was so





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**IN** a hulking industrial building next to Hawthorne Municipal Airport on the west side of Los Angeles, a machine called the Mazak AJV-60 fabricates what may well be the next rocket and capsule to carry people into space. Other machines whir and grind in the background, part of the assembly line that upstart company SpaceX—officially Space Exploration Technologies—has built in the shadow of nearby aerospace giants such as Northrop Grumman and Boeing. In the next few years, SpaceX will place the capsule, Dragon, atop its Falcon 9 rocket and send it into space carrying cargo and, the company hopes, NASA astronauts to the International Space Station.

A mockup of Dragon sits on SpaceX's main assembly floor, a short walk from an open dining area where employees help themselves to free snacks and freshly brewed coffee. Built by Northrop in 1966, the building was used most recently to assemble Boeing 747 fuselages.

Dragon looks like a larger, slimmer version of the Mercury, Gemini, and Apollo capsules that once lofted Americans into space. But if SpaceX is going to launch astronauts, it will have to become the first private company to meet a little-known set of NASA safety standards, NPR 8705.2B, "Human-Rating Requirements for Space Systems." It's NASA's guidebook for getting people to space, and was revised after the agency's last manned space system, the space shuttle, turned out to be less safe than many had expected.

NASA broadly defines human rating as a design process. Spacecraft with humans aboard must offer them enough control to get out of bad situations, and to take advantage of ways to make the flight a success. A crew must have a means to recover from all sorts of emergencies, from launch pad to orbit.

The guidelines express a philosophy: "Above all, human rating is more than a



set of requirements, a process or a certification," say the new standards, adopted last year. Wilson Harkins, mission support director in NASA's Office of Safety and Mission Assurance, says human rating is not so much a sheet of paper with boxes to check as it is an attitude. "It involves a mindset, instilled by leadership," he says, "where each person feels personally responsible for their piece of the design and for the safety of the crew."

Concerns about safety are driving NASA's plans to retire the space shuttle next year. The agency's successor program, Con-

**Originally designed to carry nuclear warheads, the Atlas rocket (above) was entrusted with taking Mercury astronaut John Glenn (right) to orbit in 1962.**

stellation, includes a rocket, Ares I, and capsule, Orion, that won't be ready until 2015 at the earliest. During the five-year gap, NASA's alternative is to buy seats on Russia's Soyuz capsule. But SpaceX's Dragon, developed in part with NASA money, may offer a homebuilt, economical alternative. The company plans to stick to a budget that would make its seats a bar-



# Is It Safe?

**Building rockets  
as if lives depend  
on it.**

**BY MICHAEL MILSTEIN**

have been 100 feet down the road," he says, chuckling. Society has grown less tolerant of risk, he says. "It wouldn't be acceptable today to put someone on an Atlas or a Titan," intercontinental ballistic missiles converted into launch vehicles for NASA's early astronauts.

Author Andrew Smith writes in his book, *Moondust*, about his conversation with Rene Carpenter, who was married to Scott Carpenter at the time he became the second American in orbit. "You know, I was on the beach with Jo Schirra [wife of astronaut Walter Schirra] for the last Atlas test firing," she says, "and it blew up right in front of us! It was terrifying, but there was a fatalism among the wives, a lot of gallows humor. You'd say 'Oh, thank God the monkey wasn't in that one.'"

With degrees in economics and physics, Musk has thought plenty about making launch vehicles safe. He considers interplanetary travel one of the most important steps in the evolution of life, which he reasons is likelier to last if it exists beyond Earth. "If the future is one where we're forever stuck on Earth, that just seems really depressing to me," he says. He sits in a corner cubicle of the SpaceX building, pondering each question during an interview. Model rockets, airplanes, and robots crowd the corners of his desk. "Exploration for the purpose of gaining knowledge is obviously a worthwhile endeavor, but it is important to remember that we're just discovering what's already there. Scientists, and I count myself partly as one, sometimes forget that science is only relevant if humanity continues to

gain at no more than \$15 million each—those on the Soyuz capsule now cost between \$35 million and \$45 million. So, SpaceX will test a key question: Is it possible to make a rocket safe enough for humans and cheaper than its predecessors?

**THE SELF-ASSURED FOUNDER** of this enterprise is Elon Musk, 37, who raked in millions starting PayPal and selling it to eBay. Musk recalls riding as a kid in the front seat of a car without a seat belt. "If there would have been an accident I would





survive.” Musk says he wouldn’t put anyone on his rocket if he didn’t think it was safe enough to fly his friends and himself.

That was particularly relevant in October 2008, just after SpaceX sent Falcon 1, its first and smallest rocket, into orbit. This followed three launches that ended with problems such as the rocket tumbling out of control. “I thought getting to orbit would be tough, but it was tougher than tough,” Musk says.

The next step is Falcon 9, a 180-foot-tall, two-stage rocket, 17 feet in diameter at its widest point, with nine of SpaceX’s regeneratively cooled engines instead of one. Falcon 9 is set for its first launch from Florida this spring.

NASA is investing in Falcon 9 through its Commercial Orbital Transportation Services, or COTS, program, to help develop private space vehicles the agency might someday hire. The seed money will help SpaceX fund the expensive process

of engineering and certifying Dragon and Falcon 9 to carry cargo and, eventually, humans to and from the space station.

SpaceX has so far met all of NASA’s milestones and is ahead of Orbital Sciences Corporation, the other company receiving COTS funding. SpaceX designed Falcon 9 and the Dragon capsule to be human-rated from the start, without any assurance NASA would ask for this. As it will dock with the manned space station, Dragon must meet about 80 percent of the human-rating standards anyway.

**HUMAN-RATING REQUIREMENTS** fall into three main areas: structural elements, such as fuel tank walls; redundancy, such as backup power and control systems; and mission design, such as launch trajectory, which determines G force—cargo can withstand a lot more of it than the human body can. Following the two shuttle disasters, NASA’s Astronaut Office in-

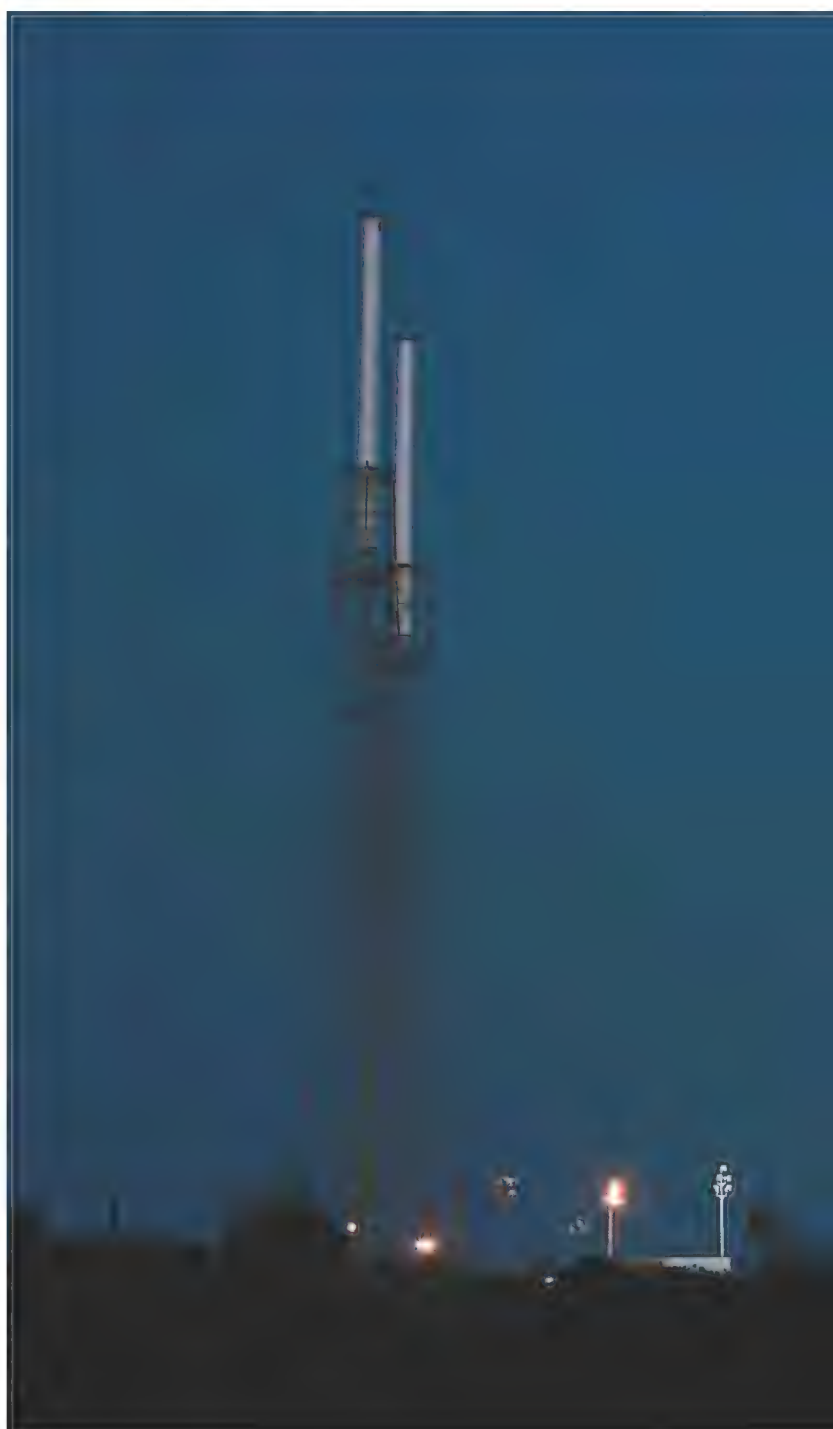
sisted that any new launch system be an order of magnitude safer than the shuttle. “If we wish to send explorers into space on increasingly ambitious missions, we must first solve the problem of putting humans into orbit more safely than is possible with our current launch systems,” the office wrote in a May 2004 memo. The shuttle is statistically likely to suffer nine fatal accidents per 1,000 launches; the Astronaut Office wanted no more than one.

Unlike the Russians’ Soyuz, the shuttle has no means of escape if something goes disastrously wrong during ascent. So NASA’s human-rating standards now require an automated abort-and-escape system that works all the way to orbit.

In fact, a vehicle less dependable than the shuttle’s boosters could be made safer with one modification: an Apollo-style abort system, which bundled powerful rockets in a small tower atop the stack to lift the capsule away from a failing boost-



SPACE X (2)





er. A similar unit on the Soyuz has twice saved cosmonauts, once on the launch pad and once in flight. NASA plans to equip Orion with such a system.

The rocket trajectory, though, must be designed so that astronauts would survive an abort. Unmanned rockets such as the Delta IV and Atlas V, which have relatively underpowered second stages, fly a “lofted trajectory,” where the first stage shoots them very high and they actually start falling before the second stage lifts them again. If astronauts abort near the high point, their capsule could plummet straight down and belly flop on the atmosphere at extreme G force. “Structural safety margins will be blown to hell, and you’ll almost certainly kill people,” Musk

**A copper thrust chamber (opposite, bottom) for a human-rated upper-stage rocket engine will help lift SpaceX’s Dragon capsule (opposite, top) to orbit.**



NASA/SPACEX

**SpaceX founder Elon Musk (above) put the Falcon 9 through ground tests (left) at Cape Canaveral, Florida, last January.**

says flatly. “This was one of the main reasons given by NASA for not using those vehicles for manned spaceflight.”

So SpaceX designed Falcon 9 with a second stage about four times as powerful as that of an Atlas or a Delta, allowing for a more slanted, softer trajectory into space. The fuel’s weight adds cost, but if astronauts abort, their flight path will catapult Dragon horizontally, slicing more gradually into the atmosphere.

Falcon 9 will be the first rocket since Saturn that can lose an engine without compromising the mission. The vehicle’s main structure will be built to withstand flight loads 40 percent higher than what engineers expect it to encounter. The safety margin for unmanned rockets is 25 percent above expected loads.

**RIDING A ROCKET** is sort of like sitting atop a controlled, sustained explosion. Falcon 9’s engines exert nearly a million pounds of force, consuming 3,200 pounds of propellant each second. The rocket must control the explosion all the way to space, while also doing battle with sound. The most intense stresses occur at liftoff, when sound energy from the engines bounces off the ground and slams back



NASA



into the rocket. Sound levels reach 140 decibels, louder than an up-close ambulance siren and enough to immediately injure human eardrums and damage components mounted near a rocket's outer skin. The most intense pressure after launch accumulates as the rocket goes supersonic, when shock waves and buffeting come close to what the rocket faces at liftoff.

Russian spacecraft, says NASA spokesman John Yembrick, rely heavily on beefier mechanical structures for safety rather than complex backup systems. In the mid-1990s, NASA compared the design and standards for the Russian Soyuz spacecraft to its own and concluded that both NASA and Roscosmos, Russia's space agency, have equivalent safety requirements, though the Russians follow a different path to meet those parameters. NASA's decision to put American astro-

"There is a correlation between predicted reliability and cost," says Jeff Ward, vice president of avionics, guidance, and control at SpaceX. "Obviously, in manned spaceflight, we are prepared to pay the cost for very high levels of predicted reliability, because life is at stake. For unmanned missions, customers trade off cost and confidence. They recognize that there is a point of diminishing returns where spending more money doesn't make the vehicle more reliable in practice, and doesn't make sense for their business plans."

But designing launch systems is as much about juggling demands as it is about engineering. "It doesn't matter whether you're doing a rocket, a washing machine,

**A four-foot-long rocket (below) will separate the two stages of Ares I, NASA's next human-rated rocket.**



nauts on Soyuz for a ride to the space station was based on the rocket's history of safety and reliability. NASA felt it would have been inappropriate to ask Roscosmos to redesign Soyuz to match NASA's human-rating process.

A sensitive word related to human rating is "tradeoff." It's always possible to build something sturdier and, presumably, safer, but at some point it will be doomed by its own weight or expense. When launching a satellite, businesses will accept a certain amount of risk as a tradeoff for keeping costs down. But the public, and by extension, NASA, will not do the same with people.

a car, or whatever it is, it's always a balancing act," says Neil Otte, chief engineer of Ares projects at NASA's Marshall Space Flight Center. He compares the undertaking to designing a table—its construction depends on whether it's to be used in a dining room or a workshop. Engineers weigh the risk of failure based on a rocket's uses, and design in immunity to the risk or put backup controls in place.

Astronauts themselves constitute a kind of backup system: They can detect and react to events, as they did on Apollo 13, in a way that mechanical systems cannot, says Harkins. However, the human-rating standards also require a form

of backup for astronauts; any manned spacecraft must be designed to guard against human error too.

The way manned spacecraft fail must meet certain standards. NASA's human-rating rules say "it is also highly desirable that the spaceflight system performance degrades in a predictable fashion to allow sufficient time for failure detection and, when possible, system recovery even when experiencing multiple failures." The simplest kind of failure, a hard fault, occurs when, say, a valve or a control panel just breaks. The more challenging kind, a soft fault, happens when hiccups in a monitoring system or computer cause it to mis-





PRATT & WHITNEY ROCKETDYNE



NASA

**Around 2020, Ares I (above) will send humans back to the moon. In a test of the next lunar lander's descent engine (left), searing hot steam turns to icicles on the supercooled nozzle as liquid oxygen and liquid hydrogen burn at 5,000 degrees F.**

sibly can and then test the heck out of them. For the Ares I rocket, specific criteria hold it to the 40 percent margin, but engineers can use a smaller one if tests allow. The shuttle's second-generation external fuel tanks were moved to a 25 percent margin, but only after rigorous testing.

For SpaceX, the only upgrades required for Dragon to carry people are the Apollo-style abort-and-escape system, seats, and a full life support system. It will cost about \$300 million to go from transporting cargo to transporting people, most of it for the escape system and the test flights the human-rating rules require. SpaceX has already negotiated the finances of this step with NASA.

Meanwhile, NASA has had to deal with a snag in the progress of its own vehicle. Early analysis of the Ares I solid rocket first stage, derived from the space shuttle's boosters, revealed that it would develop a dangerous thrust oscillation, or pogo effect, in flight. Gases swirling inside the booster would begin to resonate with the whole structure like sound vibrations in an organ pipe. About 115 seconds into the flight, astronauts would suddenly feel like they were on the end of a jackhammer, unable to read the instrument panel or flip switches. Engineers

have solved the problem with a spring-and-damper system between the booster and the second-stage rocket, and a set of 16 spring-mounted weights in the skirt at the bottom of the booster.

Other Ares I tests are yielding encouraging results, including recent firings of the Apollo-style launch-abort system in the Utah desert.

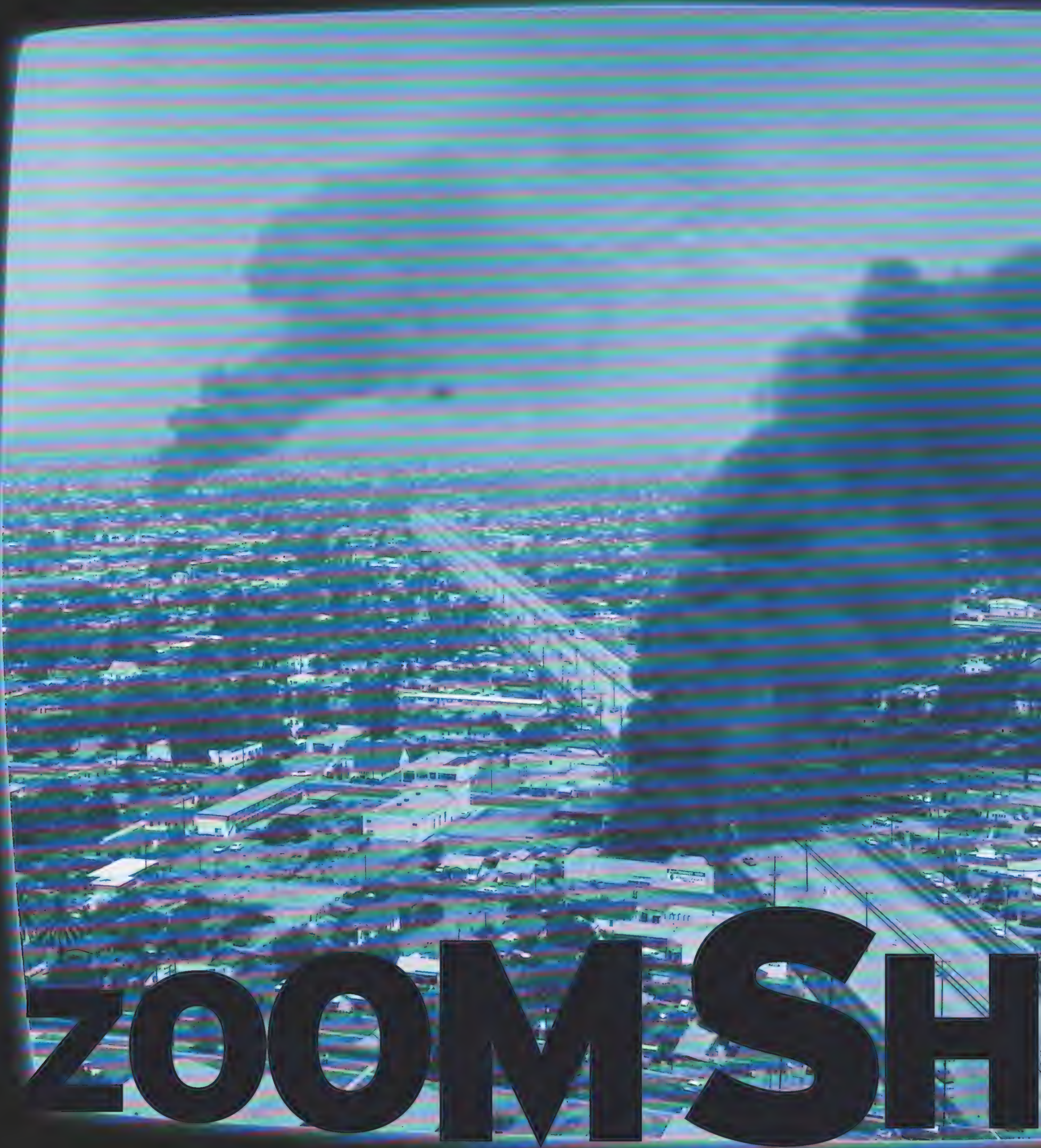
"The most obvious difference between Constellation and the shuttle is the abort/escape design," says Bryan O'Connor, chief of NASA's Office of Safety and Mission Assurance. "We did not require crew escape for the shuttle past the fourth flight. The Constellation abort system, like Apollo, Gemini, and Mercury, will be designed to save the crew from any number of catastrophic system failures."

Lesser known rockets called ullage settling motors are being tested; they'll fire for a few seconds at stage separation to nudge the top half of Ares I forward from the booster. This will cause fuel in the second, liquid-fuel stage to slosh rearward in the tanks, helping to ensure second-stage ignition. And Pratt & Whitney Rocketdyne's cryogenic engine for NASA's new lunar lander, based on the company's RL10 lunar landing engine from the Apollo days, is a critical human-rating element of Constellation. Last January the new engine completed a third round of hot-fire tests that showed it can be throttled from 100 percent down to 10 percent, and should allow for a feather-soft touchdown on the lunar surface, with humans aboard, when that day comes. —

read a situation and conclude that a valve is broken when it isn't, or vice versa. NASA's human-rating rules are not specific about dealing with soft faults. They say that designers should do everything possible to guard against such bugs in the software. SpaceX has hired an expert in the field to design a sophisticated system that polls the computers and decides what's correct.

**IN ITS LATEST HUMAN-RATING** requirements, NASA has shifted away from specific criteria—the 40 percent structural safety margin, for example—and toward the premise that engineers should make launch systems as safe as they pos-





**How the helicopter changed TV news.**

**by Stephen Joiner**





OT

For decades, helicopters have captured and broadcast vivid news footage – here, the 1965 Watts riots in Los Angeles. Aerial reporting was born in L.A.; in 1958 the first TV news helo, KTLA's Telecopter, debuted there (right, on its first flight).

**JOHN SILVA NEVER LOOKED DOWN.** Fifteen hundred feet in the air, he decided he needed to exit the cockpit of a Bell 47. As the pilot held the helicopter in a tight hover above the Hollywood Hills, Silva stared straight ahead, gripped the frame of the cockpit, stepped onto the skid, and edged back toward a long aluminum box. “I was dedicated in my heart to making this work,” he says, explaining his vertigo-defying act 50 years later. “And my calculations told me it would.”

Only it wouldn't, yet.

Tracing innovation back to its origin can be tricky; a single concept is often rooted in more than one source. But in 1957, John Silva, alone, got it. Earlier, as chief engineer at Paramount Pictures' KTLA Channel 5 in Los Angeles, he'd designed television camera trucks to broadcast from the scene of breaking news. Groundbreaking stuff in the early 1950s. But Silva, a former Navy radar officer, was not satisfied.

He began thinking about ways to stay ahead of his rivals. “I was on the Hollywood Freeway one morning and it hit me,” he says. The next advance for the video age: an airborne remote.

Silva wasn't thinking of a camera carried by a fixed-wing vehicle. He needed something that could hover. “The logical next step had to be a helicopter,” he says.

Wary of competitors, he confided in no one. On topographic maps Silva plotted signal propagation from hundreds of points around Los Angeles County to a receiving dish atop Mount Wilson, 25 miles to the north. The connected dots proved that with a 2-watt, 2-gigahertz microwave signal, coverage was possible.

The bad news: Technical difficulties. No existing TV transmitting anten-



OPPOSITE: © CORBIS; LEFT: COURTESY JOHN SILVA





**Above: Telecopter inventor John Silva installs broadcast equipment in the first iteration of the modified Bell 47. Right: Today, with the Emmy he got for his invention.**

na would fit on a helicopter. And the standard remote camera configuration would result in a payload weighing one ton. Getting up close from altitude would require a 100-mm lens, and zoomed shots demanded near-Gibraltar stability. So did the fragile vacuum tubes in the pre-transistor broadcast equipment. A heavy-lifting eggbeater, rattling windows and blowing shingles off roofs, would be banished from city limits by the Civil Aeronautics Administration. But a lighter, politer alternative, like the Bell 47, could lift only 368 pounds. And shook like a Magic Fingers motel bed.

Still, Silva presented a proposal to station manager Lew Arnold. Arnold feared a high-profile failure, and the resulting fallout from station owner Paramount. Silva recalls the manager's advice: "Go back to what you're supposed to be doing and forget this thing."

But some months later, Arnold was replaced by Jim Schulke, from Paramount headquarters. Silva delivered virtually the same pitch to the new boss. This time, he got a different reaction. "Jim told me, 'This is fantastic! What are we waiting for?'"

Schulke shared Silva's fear of being beaten by competitors. "Pick no more than two or three people you can trust," he advised. Engineers Harold Morby and Roy White were taken into confidence. The team was assigned secure workspace at Paramount's KTLA lot on Sunset Boulevard. Under deep cover, the Telecopter, as it was now called, was born.

Silva flew to New York to conspire with General Electric engineers. Intrigued by his unorthodox application, GE's Syracuse

lab designed a microwave antenna that was just three feet long. It required only a straight shot to Mount Wilson and a level flight attitude. Back in Hollywood, Paramount's special effects shop used GE's blueprints to fabricate the antenna.

The platform chosen was the iconic Bell 47. An urban-friendly flyabout, "it was the only viable choice at the time," says Dick Hart Jr., president of National Helicopter Service in Van Nuys, which leased the helo to the station. "The next thing up would have been something much larger, less reliable, and hugely more expensive."

So 2,000 pounds of broadcast equipment had to be sweated down to 368. Any metal that could be replaced by aluminum, was. To eliminate heavy, redundant power supplies, all electricity was produced by the helicopter's generator.

Recent advances in technology also worked in the team's favor. Instead of the standard tripod-mounted field camera—the size of a steamer trunk—Silva acquired a new hand-held GE vidicon, saving several hundred pounds.

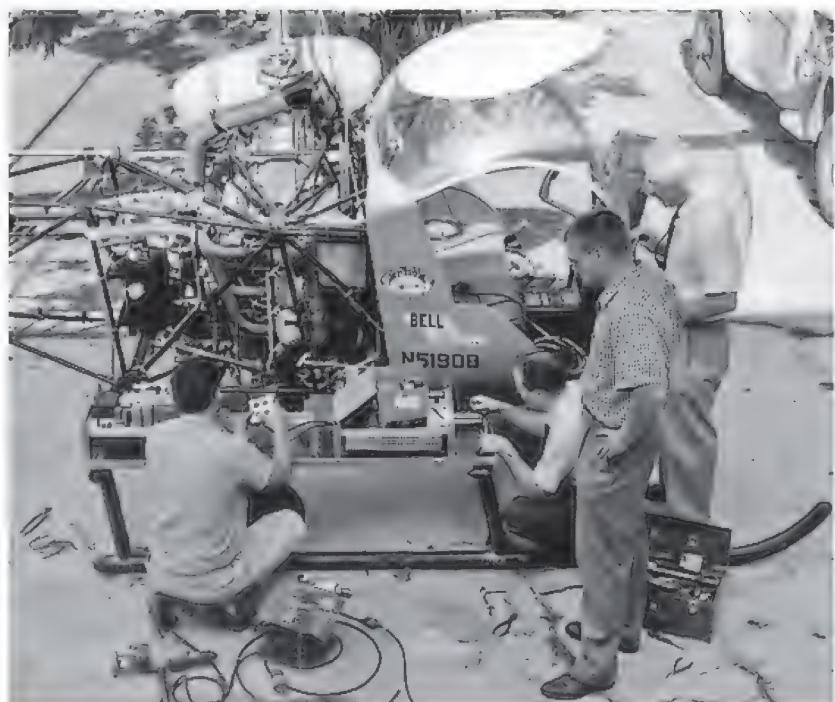
In cloak-and-dagger mode, a Bell 47G2 was spirited to an "undercover" location: Dick Hart Sr.'s Studio City back yard. "Dad had a six-acre lot where we could hide the copter and nobody could get near," Hart Jr. says. As Hart Sr. and John Silva supervised, National Helicopter me-

chanics and Paramount engineers hacked, cut, and fit.

Maxing out the payload imposed "all sorts of issues" on the small helicopter, Hart Sr. says, "particularly center of gravity." But the mods proceeded without the degree of rigor required now. "It was a more innocent time," he says. "We could self-approve alterations and installations using standard [government] data without having to meet all the engineering and flight test requirements we'd have to meet today."

Ten days later, the Bell was trucked back to Van Nuys. Though saddled with nearly every ounce of the allowed 368 pounds, it aced the CAA's weight and balance test. On July 3, 1958, pilot/announcer Larry Scheer took the stick and John Silva occu-

**In a Studio City back yard, the Telecopter team worked in secrecy, keeping competing TV news programs unaware of their aerial ambitions. Left to right: Harold Morby (back to camera), Roy White (crouching), Dick Hart Sr., and Silva. Opposite: Telecopter 2 over "Dragnet"-era downtown L.A.**





pied the cameraman/engineer position. The Telecopter lifted off and flew southeast over Hollywood, climbing into a line of sight with Mount Wilson. Silva deployed the antenna and began transmitting, and Scheer established two-way radio contact with technicians at the dish.

From the mountain came the word. But no picture.

"We were getting terrible vibration from the helicopter," Silva explains, "and the heat was horrendous." Knowing that an inflight failure would be hard to replicate on the ground for analysis, he made a snap decision. "I said, 'Larry, I've got to go out there.'"

Scheer brought the cyclic to neutral and suspended the -47 above the palms and pastel stucco. "I told myself, *I am not going to look down*," Silva recalls, "and backed out the door." Hunched on the right skid with no safety belt, he unlatched the cabinet containing the TV equipment, checking each component until he reached the microwave primary tube. It was dark. Bad vibrations.

Silva inched back into the cockpit and Scheer swung the helicopter toward Van Nuys. With Morby, White, and a Paramount machinist, they worked into the night further insulating equipment from the shake and bake. Next day, take two. At 12:48 p.m., with the roofs of Hollywood bungalows framed in the viewfinder, the two-way suddenly squawked: "We've got you!"

For the next three weeks, the team kept it all a secret.

On July 24, the station held a closed-circuit private preview at the Los Angeles Police Academy in Elysian Park, at which journalists, police, and fire officials watched, astounded, as two 27-inch monitors showed a live aerial shot of the interchange between the Hollywood and Harbor freeways. Four days later, at 6:30 p.m., KTLA preempted regular programming. In living rooms from the desert to the beach, the City of Angels from a thousand feet above—the gray-scale, low-rise L.A. of old "Dragnet" episodes—scrolled across television screens.

Regular broadcasts began on September 15, 1958, with Scheer piloting and Harold Morby as cameraman/engineer. "We had to fake it at first," Morby says today, "until we learned enough about it to work together as pilot and cameraman. I discovered pretty quick that I couldn't make fast pans and zooms when we were in motion."

On the Telecopter's undercarriage, technicians attached a flashing red "On The Air" beacon, visible for 30 miles. The *whop* of a helicopter and the dazzling light brought Angelenos bolting outdoors to wave; then they dashed inside to watch.

Up in the goldfish-bowl cockpit with no doors, it was "very noisy, very hot," Morby says. Preflight sometimes included packing temperature-sensitive TV equipment with dry ice. And that "hand-held" camera required shoulders and back too. "It actually weighed about 25 pounds," Morby says, "which got heavy after a few hours."

If the rotor's wood blades absorbed enough moisture, the rotor would become unbalanced, transmitting a bossa nova beat







DAVID KOVAR / NATIONAL HELICOPTER SERVICE

**KTLA studio staff watch Telecopter broadcasts of a fire that struck Bel Air and Brentwood in November 1961 – at the time, southern California’s worst brush fire.**

through the drive train and into Morby’s live shots. To steady him, a camera seat was fabricated from bedsprings.

One problem the team avoided: boredom. “Sixteen years, 13 emergency landings,” Morby says. Nothing they couldn’t walk away from, though one close call could have dropped them in the Pacific.

Once a revenue flatliner, local news became a cash cow. During the Telecopter’s first four months, KTLA sold a record \$500,000 of advertising. Procter & Gamble spent another \$250,000 specifically to sponsor Telecopter coverage.

In 1959, the project’s success earned an upgrade. Telecopter number 2, a Bell 47J2, offered greater interior space, as well as increases in lift and range. All equipment was interior-mounted, obviating extravehicular troubleshooting.

Other channels began conceding KTLA’s advantage. Minutes after an Orange County train wreck, Scheer and Morby were above the action. Three live airborne newscasts were already wrapped before a Channel 11 truck rumbled up. As the Telecopter circled above, “the crew got out and just stood there, looking up at us,” Harold Morby says.

At some historic moments, the Telecopter was the only vantage point that was available.

On December 14, 1963, high above the Los Angeles suburb of Baldwin Hills, a hilltop reservoir dam developed a crack. KTLA interrupted its sedate Sunday morning pro-

gramming with Telecopter pilot Don Sides’ terse narration. Viewers looked down on the collapse of the dam in horrifying real time, watching as 300 million gallons of water rampaged through the neighborhood below, killing five people and destroying 277 homes. The Telecopter coverage is credited as the first live aerial broadcast of a disaster.

Two years later, a drunk driving arrest on an August night in Watts escalated into a 50-square-mile riot. As mobs stoned cam-

era trucks, the Telecopter remained in the air and broadcasting. Leaning out the cockpit, Harold Morby captured exclusives for KTLA and also fed national networks. Even the LAPD and National Guard requested live views for tactical purposes. Morby recalls dodging behind plumes of arson smoke to evade bullets from a Cadillac stalking them below. The landmark coverage earned the first Peabody Award for an airborne newscast.

By the late 1960s, John Silva was restless with monochrome and the limitations of piston power.

Paramount had sold KTLA to Gene Autry’s Golden West Broadcasters, and the small screen was blooming with living color. Silva was fascinated by a shot in the film *Funny Girl*, a long, rock-solid zoom from a helicopter. He learned that a gyro-stabilized platform had been developed for 35-mm movie cameras, and traced the inventor to a small Canadian company. The two collaborated on a version compatible with television cameras.

Silva sat down with Autry and laid out a big-ticket proposal: acquire a Bell Jet Ranger and create the world’s first color Telecopter. Autry, once the Singing Cowboy, was also a World War II C-47 pilot and lifelong aviation enthusiast. Silva remembers Autry’s response: “Spend whatever it takes, John. Just do it right.”

Telecopter number 3 debuted with tur-

**Silva fits Morby with a harness-mounted camera, a setup requiring the cameraman to lean from the helo. Hand-held cameras proved less nerve-racking.**



COURTESY HAROLD MORBY





COURTESY JOHN SILVA

bine-powered, gyro-stabilized, color coverage of the 1969 Rose Bowl parade. With that advance, Silva established the prototype of the newsgathering helicopter that prevails today.

Since then, a specialized breed of aviator has evolved, one adapted to the medium of live television. “We don’t fly like normal pilots,” says Desiree Horton, a contract news pilot for several Los Angeles channels. Today, at the stick of a jet Eurocopter on her way to breaking news, she explains how the job is distinctive. The shortest path to time-critical events is a straight line through busy, controlled airspace. After takeoff, Horton must secure first-come, first-serve clearance across the city ASAP, or risk being diverted by a controller swamped with requests from competitors.

Once on site, a skill set specific to live TV kicks in. Sharp movements can “tumble” even cameras that have been gyro-stabilized, so flight technique is constrained. When “getting vertical”—shooting straight down—gyro-stability is weakest. Avoiding vertical while covering a high-speed, zigzagging police pursuit requires concentration and dexterity.

**KTLA’s fleet, mid-1960s. Telecopter 2 sports red livery. (KMPC News’ helicopter broadcast on the radio.) From left: Silva, Morby, and Telecopter pilot Larry Scheer.**

On morning and afternoon flights, Horton’s flying has to avoid angles at which the California sun can zap the lens. Bright white buildings and rooftops play havoc with color balance, so she maneuvers those out of the shot too. Through it all, the helicopter must be oriented so the belly-mounted microwave beam clears the skids and camera pod.

Another necessary skill: “parked” hovering, high above a protracted incident (like an all-day hostage drama). Long-duration hovering can be draining. “It’s really an odd sensation to hover out of ground effect at high altitude for so long,” says Horton. “Sometimes we’ll hang there for two or three hours on a story, then go refuel, and come back and hover some more. And though you’re only hovering, you’re still flying that aircraft every second. But it’s really more mentally tiring than physically.”

With every major L.A. television station having a news helicopter (there are eight total), the pilots are rivals, but they’re amiable too. Horton maintains air-to-air chat-

ter with the competition. “When you’re flying news in L.A.,” she explains, “you’ve got eight other helicopters racing you to get to the scene first. We’re talking all the way.” Pilots know their stations are monitoring live images from other channels’ helicopters. “Basically we’re expected to get that same shot, or something better,” Horton says.

**IN JOHN SILVA’S** Los Angeles home, an Emmy award for inventing the Telecopter stands next to a model of little Telecopter 1. Only days from the golden anniversary of that first airborne broadcast, 88-year-old Silva is not looking back—or down. I wonder how he feels watching high-def coverage beamed 24/7 from news choppers like Desiree Horton’s today, and knowing every one is a direct descendant of his 1957 brainstorm.

“I never thought about being a pioneer,” he laughs. “All I ever wanted to do was get us there and get the picture—before the competition got it.” —



# Resto

## Spruce, Leather, Mohair, Mahogany



NASM (SI 75-5010)

The aircraft type was called Staggerwing because its top wing is set slightly aft of the bottom one. Aimed at the corporate market, it debuted in 1932 for \$14,000 and up. During the aircraft's 15-year production run, Beechcraft built 785.

Construction was largely spruce and fabric; interiors offered leather, mohair, and mahogany. The 200-mph biplane also served as a racer, a bomber for Republican forces during the Spanish Civil War, and a VIP transport for the U.S. Army Air Forces in World War II. The Army and the Navy bought 260 and commandeered as many as they could find from private owners. Such was the case with Cizek's airplane, which flew courier duty for the Navy along the U.S. East Coast and later was sold as surplus.

Today, the 200 or so Staggerwings that remain are regarded as flying works of art. A rare G model in mint condition can fetch perhaps \$525,000.

Cizek became enamored with Staggerwings as a boy when he saw a model in a hobby shop. In 1979, he read an ad for one in *Trade-A-Plane* and called the seller, Tom Todd, a cotton broker and World War II PBY pi-

**LLOYD CIZEK POINTS** at his chest. "I had a little electrical problem, so they had to install an auxiliary power unit," he says, joking about his cardiac pacemaker. Cizek retired as a Northwest Airlines 747 captain in 1990, and since then has been in an on-again, off-again battle with the Federal Aviation Administration over his pilot's medical certificate. Now the only way he can get it back is to run nine minutes on a treadmill while hooked up to a heart monitor. "I just can't do that," he says.

Behind Cizek, in his hangar in Amery, Wisconsin, sits his 1940 Beechcraft D17S Staggerwing, serial number 398, which he has owned since 1979. Its nine-cylinder, 450-horsepower Pratt & Whitney Wasp Junior radial engine slowly leaks oil into a drip pan on the floor.

Cizek calls his Staggerwing *Lais*, after the fourth century B.C. courtesan from the Greek city-state Corinth. A plaque inside the door notes that she was "known

for her beauty and fine lines and also had a reputation for being somewhat fast." "Can you think of a better name for a Staggerwing?" Cizek says with a grin.



The aptly named *Miss Streamline III* (top) sets the bar high for Staggerwing restorers. Lloyd Cizek's "basket case" was prepped for transport (above) and spent the next 18 years in intensive rehab in Cizek's Wisconsin hangar (right).



COURTESY LLOYD CIZEK (2)



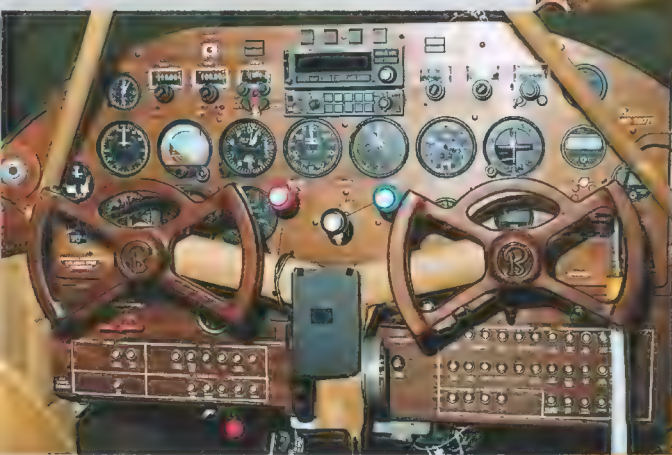
# ration

## Beech Staggerwing

**Top to bottom: The rebuilt engine's gleaming prop spinner; the updated instrument panel, crafted from walnut; pilot and restorer with his *Lais*, named for a fourth-century B.C. courtesan; a Staggerwing D17S, reborn.**



MARK HUBER



lot. Todd explained that the airplane “was a basket case,” in pieces in a barn on his Mississippi farm. Undeterred, Cizek lashed the Staggerwing’s remains to a borrowed trailer and headed home.

Cizek spent the next 18 years learning woodworking, metal forming, and wiring and obtaining an airframe-and-powerplant mechanic’s license and an aircraft inspector’s license. He stripped the airplane to the frame, replaced the engine with a rebuilt one, and upgraded the electrical system from the original 12-volt to a modern 28-volt so the airplane could carry modern radios, GPS technology, and autopilot. However, the replacement avionics and radios were narrow and long, while the originals were wide and short. Cizek made 10

instrument panels until he got it right.

Employing a borrowed English Wheel, a device for forming flat sheets of metal into compound curves, Cizek fashioned a more aerodynamic cowl. He modified the retractable landing gear to make it more reliable, upgraded

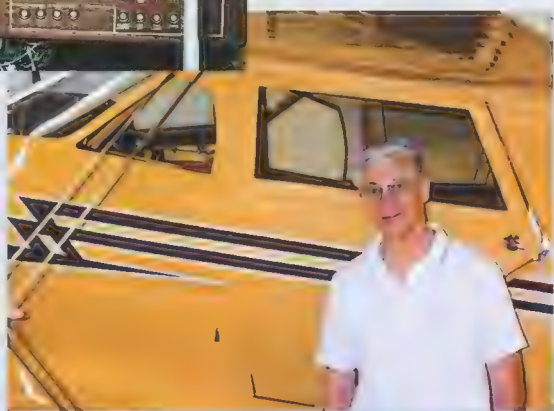
the brakes, and changed the tail-wheel setup to make the airplane easier to tow. He installed modern fuel valves and fuel monitoring systems, gutted and recovered the interior, and designed and installed an all-metal firewall—“The old one was fabric,” he says incredulously.

Finally, in 1997, Cizek ran out of things to change or

fix and the FAA signed off on his work. “They gave me an ‘A’ for airplane and an ‘F’ for paperwork,” Cizek jokes. However, by then Cizek’s medical issues had squelched his opportunity to fly. “When I could fly, the airplane couldn’t, and vice versa,” he says. Over the last decade, Cizek has flown the Staggerwing only 12 hours. But he’s not bitter. “It was a lot of fun. I got more joy out of solving the problems and making things,” he says. “Everyone has to stop flying sometime.”

He pulls on the cowl and notices water leaking out, leftover rain the Staggerwing encountered on the way home from the Experimental Aircraft Association annual fly-in at Oshkosh, Wisconsin, just a few days earlier. Cizek’s friends flew the airplane there, parked it in the vintage aircraft section, and threw a “for sale” sign on the propeller. Asking price: \$375,000. There were no takers. As Cizek tells me this, I get the feeling that he is not entirely disappointed.

MARK HUBER



COURTESY LLOYD CIZEK (2)



MARK HUBER



# SHOULDER



NAVAL HISTORICAL CENTER

# to SHOULDER



## WHEN THE WEATHER IN VIETNAM KEPT MOST AIRCRAFT GROUNDED, THE NAVY SENT IN THE GRUMMAN A-6.

ON A MAY AFTERNOON IN 1972 a flight of four Grumman A-6 Intruders, the lead elements in an air wing strike, flew a hundred feet above North Vietnamese rice paddies west of the Gulf of Tonkin, about 25 miles south of Hanoi. Loaded with Mk 20 Rockeye bomblet canisters, the jets were headed toward

BY RAFAEL LIMA

Bai Thuong, an enemy airfield. Navy pilot and air group commander Roger Sheets flew the lead Intruder. He and his bombardier/navigator Charlie Carr, a Marine Corps captain, used the aircraft's radar and visual cues to guide them to Bai Thuong. "The A-6 was the all-weather attack aircraft," says Carr. "Monsoon season never affected our operations." But that day was clear; Sheets and Carr were getting a good look at North Vietnam, and any other aircraft sharing that patch of sky could get a good look at them.

As the Intruders approached their target, they climbed to 200 feet. From the right seat, Carr spotted enemy MiGs above. They looked like little arrowheads circling watchfully about 1,500 feet up. He threw a switch and informed Sheets that the A-6's three-plus tons of ordnance were now armed.

"We came in underneath this wheel of MiGs," Carr recalls, "maybe 12, 15 of them. We were hoping to catch them on the ground and bomb the hell out of 'em. The airbase was alerted, however."

Sheets kept the A-6 straight and level as they approached the airfield. A few seconds later he thumbed the release on the stick, freed all 12 Mk 20s, and banked the Intruder hard to the left.

Carr remembers seeing one of the MiGs dive toward them. "OK, so now we had a problem," says Carr. "Now the MiG-17 was on our tail."

Compared to the MiG, the A-6 was no sprinter. Carr armed the aircraft's Sidewinder missiles, but there was little chance that Sheets could get into a position to take a shot. Instead, he began to jink, performing quick dodging maneuvers that made it tough for the MiG pilot to keep them in his sights. Sheets intended to drag the MiG toward the coast, hoping to run it out of gas. Carr remembers seeing puffs of smoke from the MiG's 37-mm cannon. That's when an F-4 Phantom appeared like a big brother late to a fight. The F-4 fired a missile, the MiG went down in flames, and Sheets and Carr made it back to the USS *Coral Sea*.

MiGs were among the reasons that A-6 crews pre-

ferred the cover of darkness or nasty weather. Using terrain-following radar, the crews flew low and fast no matter the hour. Because of the complexity of carrier operations, says Carr, only about a quarter of his flights from the *Coral Sea* were at night. "But missions from land," he says, "were almost all at night."

If darkness suited the A-6, perhaps one reason was that the airplane was no beauty queen. The twin intakes for the Pratt & Whitney J-52 P-8B turbojets swelled amidships, giving the craft a portly look. A bent refueling probe protruded from the top of a large, rounded snout. "The plane wasn't pretty," remembers Carr. "Only Grumman could make a plane that ugly."

**THE INTRUDER'S GENESIS** predates Vietnam. During the Korean War the U.S. Navy lacked an all-weather, carrier-launched strike aircraft. So in March 1957 the service's Bureau of Aeronautics issued a request for proposals, detailing a requirement for a subsonic, two-seat attack bomber. Boeing, Douglas, Vought, Martin, Bell, Lockheed, Grumman, and North American submitted a total of 11 designs.

Interviews with flight crews led designers to focus on crew coordination. "The Navy wanted the side-by-side seating," says Joe Ruggiero, a Grumman

A two-man crew (below) descends from an A-6 on the USS *Independence* after a mission, their aircraft eclipsed by a huge nose built to house radar equipment. A pair of Intruders (opposite) returns to the USS *Ranger* in the Tonkin Gulf.



NAVAL HISTORICAL CENTER



engineer who worked on the A-6 from the prototype to the final A-6F, and was later a Northrop Grumman program director for the EA-6B Prowler, the Intruder's electronic warfare variant. "They thought, correctly, that it would enhance the workload in the cockpit. The design team knew it was going to be a bomber, and the radar system requirements did not lend themselves to a pointy nose. The engineers designed a plane that could carry lots of ordnance under the fuselage and wings. What eventually showed up on the drawing boards was the configuration of the A-6 Intruder."

Grumman won the design competition and signed the contract early in 1958. Two years later the prototype rolled out and the insults rolled in. "The pointy end was on the wrong end," says Carr. Some called it a "flying drumstick." "Well, it was a really ugly plane when you first looked at it," says retired Rear Admiral Rupe Owens, who has flown every version of the A-6. "But when it went to work flying in combat, the tadpole-looking plane became a thing of beauty." John Vosilla, a Northrop Grumman spokesman, bristles at the put-downs. "When we look at a project at Grumman, we're looking at engineering, not works of art," he says.

"To me and my team," says Ruggiero, "it was a beautiful airplane."

Both Charlie Carr and Rupe Owens liked the Intruder's side-by-side seating. So did the Marine Corps' Bruce Byrum (now a retired general), another Vietnam veteran who, like Carr and Owens, logged more than 3,000 hours as an A-6 pilot.

"There was a lot the bombardier/navigator could do to help," says Byrum. "He wasn't just a passenger along for the ride to operate the weapons system." A good bombardier/navigator, he says, monitored the radio, rate of descent, airspeed, power settings, and attitude, as well as the aircraft's place in the landing pattern as crews returned to the ship. "He had as much to do with the pilot's success as the pilot," Byrum adds.

Carol Reardon, a military historian at Pennsylvania State University and author of *Launch the Intruders*, an account of a Vietnam-era A-6 squadron called the Sunday Punchers, finds that the crew concept was critical to the Intruder's success in Vietnam, where it flew 35,000 combat sorties. "Pilots and B/Ns [bombardier/navigators] had to learn to trust each other's skills," she writes. "Repeatedly, instructors reminded them that the A-6 required two minds functioning in synch with each other. Both members of an A-6 crew got the same award for the same mission. Both suffered the consequences of an error. The A-6 community could afford no loners."

The crews say that the two-abreast arrangement enhanced interaction. "With two guys sitting side by side, you could communicate with hand gestures, if need be," says Owens. "You could simply look at the other guy and nod."

Good communication was important in dodging surface-to-air missiles (SAMs). Intruder pilots relied on their own skills at low-altitude flying, the eyes of their bombardier/navigators, and the power of their Pratt & Whitney engines.

"You could outfly the SAMs with the A-6," says Owens. "What you did was make hard turns. At their



COURTESY CHARLIE CARR

**Charlie Carr** (above, left) survived three tours in the A-6 and two ejections from it. He poses with Bill Fitch in front of an Intruder loaded with 28 Mk 82 bombs at Chu Lai Air Base in South Vietnam. The A-6 was also a refueler (right).



NAVAL HISTORICAL CENTER





## The Flying Drumstick

The Grumman A-6 Intruder, more beast than beauty, was designed for a specific mission: hauling bombs to the target at night in any weather, and delivering them accurately. Of all carrier-based aircraft, the A-6 could launch with the heaviest bomb load, about six tons. This is an A-6A, the original operational model. Perhaps its most distinctive feature was the rhino-style refueling probe on the nose. Today, the Intruder's only flying descendant is the EA-6B Prowler, a four-seat, electronic warfare variant soon to retire.

intercept speed of about Mach 3, the SAMs couldn't turn with the A-6, especially at low level." Owens remembers approaching a target when points of light far ahead came at his airplane, streaming long, bright tails of flame, five in all. "We managed to out-turn them all, but I remember the sound of those five rocket motors from the SAMs as they went by. It got loud. Real loud."

SAMs harassed many A-6s, and took their toll—of the 69 Intruders lost to combat in Southeast Asia, 36 were claimed by anti-aircraft fire, 10 by SAMs, and only two by MiGs.

**THE INTRUDER EARNED A REPUTATION** as a dependable attacker that could drop bombs in pitch darkness in any weather on both stationary and moving targets. Its reliability was due mainly to a new bomb release tool, the Digital Integrated Attack and Navigation Equipment system, or DIANE. Coupled to an analog computer, the system could take into account any angle of climb or dive, speed, G force, and wind and calculate when to drop a payload accurately. DIANE's Vertical Display Indicator

gave the pilot a representation of terrain, sky, and horizon, as well as heading, radar altitude, vertical speed, and angle of attack. The aircraft's terrain-hugging capability was key to low-altitude missions. When Intruders were striking some targets, A-7 Corsairs and F-4 Phantoms flew along in formation and released their ordnance when directed by the A-6 crews using DIANE.

The Intruder also carried an Airborne Moving Target Indicator, a unique doppler radar that gathered returns from moving ground objects. And ground-based acoustic and seismic sensors, air-dropped along supply trails, provided another method for A-6 crews, with the help of ground controllers, to find targets moving on such routes as the Ho Chi Minh Trail. "Sometimes at night," says Byrum, "enemy anti-aircraft fire used colored tracer rounds fired aimlessly into the night sky when aircraft were detected flying in the area, to warn all vehicles on the road that we were there." Intruders generally dropped Rockeye cluster bombs first, which pierced vehicles' gas tanks or weapons caches and set off secondary fires. These provided visual aim points for a second pass, in which crews



The forward, inside bomb racks on an A-6 (right) during a 1968 tour in the Tonkin Gulf were left vacant to avoid blocking the landing gear doors. But it carried a payload of 22 500-pounders. A spacious canopy (below) provided excellent visibility.



NORTHROP GRUMMAN

would drop Mk 82s. In the absence of secondary fires, they would head off for preassigned secondary targets.

The Intruder absorbed lots of punches. On one daylight mission, North Vietnamese 23-mm anti-aircraft fire damaged an A-6 in Byrum's squadron. The crew diverted to Da Nang.

Byrum flew close to look them over and escort them to the airfield.

"It was hard to believe that the aircraft was still flying," he says. The A-6 had taken a direct hit to the leading edge of the right wing near its root. The pilot, in the left side of the cockpit, couldn't see the damage. His bombardier/navigator could, though, and had apparently decided to say little about it, probably hoping to delay an ejection over enemy territory. "The hole in the wing was about the diameter of a 50-gallon drum," says Byrum. "You could see the landing gear up inside the now-visible wheel well." Miraculously, no fuel or hydraulic fluid sprayed out, so Byrum and his navigator refrained from reporting the damage to the pilot. No sense in unnerving him.

Byrum followed the stricken Intruder to touch-

down. By the time he taxied up, the pilot of the damaged A-6 had shut down and climbed out. Coming around to the starboard side of his airplane, he was stunned by what he saw. "His first reaction was to knock the bombardier/navigator to the ground. Obviously, he wasn't happy," Byrum recalls. "We didn't bother to open our cockpit. Although we couldn't hear what he was yelling, he was just as upset with us. I don't know what he would have done differently. He surely did not want to eject."

"They didn't call it the 'Grumman Iron Works' for nothing," says Ruggiero. "Look at the Wildcat and the Hellcat. We built planes that would take the fight to the enemy and bring back safely the youngsters [who] flew them."

Back on the ship, 'round-the-clock, all-weather ops made one day meld into the next for A-6 crews. They often flew two missions per day—one attack and one as refuelers for the rest of a carrier's air wing. There was little free time. "If they weren't flying their combat mission," says Reardon, "they were planning it or debriefing it—and that took several hours in itself."

The crews did have moments of relaxation. "Movies were very popular," says Reardon, "if they were not very new—and not always G-rated." When the films began to grow old, the crew ran them backward for kicks, making up their own dialogue—"like kids used to do with old Japanese monster movies," she says. Carr recalls wearing out the 1971 shark documentary *Blue Water, White Death*. "We sat and watched it I don't know how many times. By the end of that



cruise we'd seen every damned shark in the world."

For some squadrons, says Reardon, the transit from the States involved a little below-the-radar, late-night drinking to dull the anxiety of what lay ahead. Once active air ops began, though, they refrained. "They saved the craziness for their times between [periods when the carrier was on combat station], when they went ashore in the Philippines," Reardon says, "or some exotic location such as Singapore or Hong Kong." Carr doesn't recall any drinking on the transit. "Doesn't mean it didn't happen," he says. "I just didn't see it. We did operations planning. We had targets, and we had to plan 'em. And we flew." He does remember a stop in Hawaii. "We pulled into Pearl [Harbor] and raised holy hell for a couple days." And when they got orders to come off the line for the last time and head home, he remembers that, magically, beer and spirits appeared.

**THE NAVY RETIRED THE A-6** on February 28, 1997, after 693 had rolled off Grumman's assembly line. By then it had inspired a shoulder-to-shoulder camaraderie. The Intruder Association, which Owens chairs, carries that torch, gathering pilots and bombardier/navigators to share stories and rekindle friendships.

"The Navy and the Marine Corps finally got a plane that could unite the services," says Carr. "You'd never get those guys together, except for their common love of the A-6." He would receive 10 Distinguished Flying Crosses and a Silver Star, and flew in Operation Desert Storm. Carr retired a full colonel in August 1994.

The Intruder's precision strike role was briefly handled by the F-14 Tomcat. The other multi-crew tactical aircraft of today—the F-15E Strike Eagle and the F/A-18F Super Hornet—are, like the Tomcat, tandem seaters, with the weapons systems officer behind, not beside, the pilot. Their fundamental design rule is to be streamlined. These aircraft are expected to do it all: attack, dogfight, recon, electronic warfare. The F/A-18 is a tanker too. They sport broad wings for maneuverability, but they're packed with the tools for ground attack. They're designed to fight their way in, deliver their payloads, and fight their way out.

The A-6's shoulder-to-shoulder cockpit is now a quaint curiosity in the pantheon of aerospace engineering. Another shoulder-to-shoulder workhorse was the General Dynamics F-111, which was retired in 1996. Grumman's electronic warfare version, the EF-111A, was retired in 1998. That leaves the EA-6B Prowler. Though the Marine Corps may fly the Prowler into the next decade, the Navy plans to fully convert to the tandem-seat EA-18G Growler by 2012.

Ruggiero reflects warmly on his airplane. "We didn't have to be supersonic," he says. "Our plane was a good truck and didn't have to be pointy. We had to deliver weapons to the target in all kinds of weather."

Reardon remembers a bombardier/navigator who offered a suggestion for her book's cover that he thought would perfectly suit the airplane and its mission. "He said, 'You should make the cover pitch black, black as the darkest night, and make it sopping wet.'"



NAVAL HISTORICAL CENTER

On the USS *Constellation* late in 1968, a catapult crewman gives the signal that an A-6 is ready to launch. A centerline D-704 refueling store augmented the four drop tanks beneath the wings. The D-704's propeller, driven by wind in flight, powered a motor that extended and retracted its refueling hose.





EVERY





# THE MAN WHO'S FLOWN

# THING

**AN HOUR BEFORE THE DOORS** of the National Air and Space Museum's Steven F. Udvar-Hazy Center opened to visitors, the vast, multi-level space was filled with a theatrical pre-curtain hush. Only a few docents were here, getting reacquainted with the 170-some air- and spacecraft on display, machines that had made some of the most important history of the last hundred years. The docents were there to tell their stories.

So was the man I'd traveled to Chantilly, Virginia, to meet: Robert "Hoot" Gibson. Hoot (the nickname originated with cowboy movie star Edmund "Hoot" Gibson) knew many of these flying machines personally. From light piston aircraft to thundering World War II fighters to supersonic jets to the space shuttle, Gibson had flown them—108 types so far.

He arrived one minute early. Though 62, he looked very much as he did in shuttle crew photographs from the early 1990s: the same trim build, the same mischievous glint in his eyes.

"So where would you like to start?" he asked.

"How about the beginning?" I said.

**How many pilots can say they've flown an L-39 Albatros (opposite, top), a space shuttle (opposite, bottom), and a 737 (left)? Hoot Gibson's career includes over 100 aircraft types, and he is now hoping for a gig flying a tourist spaceplane.**

As we walked through the quiet museum, Gibson told me about his early influences. His mother was one of the few women to fly general aviation aircraft in her day; as a college student in 1943, she and two girlfriends had chipped in to buy a J-2 Taylor Cub. His father was a test pilot for the Civil Aeronautics Administration; as a kid, Gibson accompanied him on CAA business and slowly learned the art of flying. One day they were in Phoenix, having flown there in a Bonanza with one control yoke. "When it was time to return to L.A., he passed the control wheel over to me in the right seat and said, 'It's your takeoff.'" Gibson was 10. "I was so proud that he trusted me," he recalled. "He was my inspiration."

Gibson pointed at a diminutive Piper Super Cruiser hanging from the rafters. It was the *City of Washington*, the first light, personal airplane to fly around the world. "I soloed in a [Piper] Colt on my 16th birthday; it was similar to that Super Cruiser up there," said Gibson. "We were living near Manassas, Virginia. The airport was just a grass strip, and it was a nasty day to fly: windy, rainy, a solid overcast. But my dad thought I was ready." He got his private pilot's license the following year.

We left the civil and general aviation displays and continued on to Modern Military Aviation. Gibson told me that in 1969, he graduated from college and entered the U.S. Navy Aviation Officer Candidate School in Pensacola, Florida. He never considered any career other than flying.



DUNCAN CAMERON

**THERE MAY STILL BE A FEW  
COCKPITS HOOT GIBSON  
HASN'T SAT IN.** BY ROBIN WHITE





We stopped beside a McDonnell F-4 Phantom. As a young Navy aviator, “I was in awe of the F-4,” he said. “It looked so big and heavy, and the wings seemed so small.... I was reluctant to slow it down. I was sure it would fall out of the sky.” But “it was just totally rock-solid on approach to the carrier,” Gibson said. “It flew on rails at 145 knots.”

From 1972 to 1975, Gibson flew three tours in Southeast Asia off the carriers *USS Coral Sea* and *Enterprise*. He was looking forward to shore duty when his commanding officer asked an unusual question: “How would you like a third tour?”

“My initial reaction was: ‘Is that a joke?’ I was extremely ready to hit the beach. But then he said, ‘In an F-14.’

“No way I was turning down something like that,” Gibson said.

He was assigned to the first F-14 squadron: VF-1 at Naval Air Station Miramar in California. “I had just 30 hours in the F-14 when I went up against a thousand-hour F-4 guy. We called ‘Fight’s on!’ and 30 seconds later I was sitting in his six [behind him]. We ran the engagement three times. The results were always the same. An F-14 with a nugget [novice] at the stick could outmaneuver, outturn, and outfight a Phantom flown by an old hand.”

In 1976, Gibson got a slot in the test pilot school at Maryland’s Naval Air Station Patuxent River. There he learned to methodically wring out new designs—single-seat jets, heavy transports, helicopters—moving step by step from known to unknown. “I was exactly where I wanted to be, doing exactly the kind of flying

I wanted to do. Then I picked up a copy of *Aviation Week & Space Technology* and saw an artist’s drawing of the space shuttle.... The shuttle was the fastest, highest-flying airplane in history, and I just had to snivel my way into the left seat.”

He sent the paperwork in to NASA. On January 16, 1978, he got the news: He was in.

That day, NASA named its eighth group of astronauts. One, a surgeon named Rhea Seddon, later became Gibson’s wife. Today, they live in Murfreesboro, Tennessee, and have four children, Julie, Paul, Dann, and, the youngest at 13, Emilee.

We left the F-14 and made our way to the Museum’s space hangar, where the shuttle *Enterprise* reigns. “The shuttle doesn’t fly like anything else,” said Gibson. “The control surfaces are huge. When you move them, you reduce your wing area, so, at first, pulling up makes you sink. Pushing over makes you sink faster. Pulsing the stick gets you into serious trouble. Below a certain altitude, every input you make is going to be wrong.”

Gibson was picked to serve as pilot for a 1984 *Challenger* mission. The flight marked the first untethered spacewalk, and the first shuttle landing at the Kennedy Space Center in Florida, instead of Edwards Air Force Base in California. Gibson’s next mission would be as *Columbia*’s commander. Once in orbit, bad weather at various landing sites kept the crew up longer than scheduled. The launch of the next shuttle, *Challenger*, was pushed back to January 28, 1986, a morning that dawned very cold.



"I was doing a debriefing at the Johnson Space Center in Houston," Gibson recalled. "The launch looked perfect." But at T-plus-73 seconds, a stiff, cold-soaked O-ring in the right solid booster failed. A flare of gas burned through to the external fuel tank.

"I kept staring at the television," said Gibson. "It took a couple of minutes before I realized that I had just watched my friends perish. Mike Smith was my instructor at test pilot school. Ellison Onizuka was my office mate for four years, Dick Scobee and Judy Resnik were both in my astronaut class. I flew my first spaceflight

**Opposite: The pilot in his 100-horsepower Cassutt racer, in which he set world altitude and speed records. Below: Gibson first soloed in a jet in 1970, flying this T-2A trainer. Below right: Gibson's parents, Paul and Rita, with Rita's Piper Cub, ca. 1943.**



LEFT: DICK GRAY; OPPOSITE: CORNELIUS BRAUN



GIBSON FAMILY COLLECTION

with Ron McNair. I'd lost friends before in aviation, but never so many all at once."

Gibson next commanded a classified military mission, STS-27, to carry a surveillance satellite into orbit. *Atlantis* lifted off on December 2, 1988, at just after 9:30 a.m. But at T-plus-85 seconds, part of the nose cap on the right-hand solid booster broke loose and shattered against the orbiter's wing.

"Dave Hilmers, our CAPCOM [capsule communicator], called up and told us they'd seen something fall away from the vehicle," recalled Gibson. "It probably was no big deal but we ought to take a look. Luckily, *Atlantis* had the remote arm in the cargo bay. We used the camera on it to look around." The bottom of the wing looked like it had taken multiple

shotgun blasts, the thermal tiles showing white scrapes and dark, jagged holes. Gibson relayed the images to Houston. Because STS-27 was a military flight, the data were encrypted, the pictures low-resolution.

"The engineers came back and said it didn't look any worse than they'd seen on previous missions," said Gibson. "Well, I'd been with the shuttle program from the start.... I knew for a fact there'd been nothing like this before."

Reentry heat topped 3,000 degrees. The aluminum under the shuttle's tiles melted at 1,000. But reentry was four days away, and the crew focused on deploying the satellite, trying not to think about the orbiter's damaged belly glowing white-hot at Mach 25.

"We didn't know if Houston really thought we were okay," remembers crew member Mike Mullane, "or if they knew the situation was hopeless and just didn't want us to panic. But we knew what we'd seen, and Hoot was seriously ticked off that mission control wasn't listening to him. Things got pretty quiet up there."

Gibson felt that if something bad was going to happen to *Atlantis*, Houston was going to know why. If the right wing started to burn up, he said, "the first sign would be a 'split' in the elevons as the controls tried to hold attitude against increased drag. If they differed left to right by more than two degrees, I was going to

get on the mike and tell Houston exactly what I thought of their assessment. I figured I had 30 seconds. It wouldn't help us, but it might save a future shuttle crew."

**Below left: With wife Rhea Seddon, before her 1993 shuttle mission. Emilee (below) may follow in her father's contrails; Gibson plans to teach her to fly his recent acquisition, a Beech Bonanza.**



NASA



HOOT GIBSON



Reentry began. Gibson kept his eyes on the elevons. The shuttle entered the region of maximum thermal stress. The elevons remained in synch; the wing stayed intact. Gibson brought the orbiter in for an exceptionally smooth touchdown at Edwards.

"When we got out, we saw a bunch of engineers gathered under our wing. They were shaking their heads. The damage was massive. A whole tile was missing where the L-band antenna was mounted. There was a thicker skin panel there, and the metal had partly melted. If we'd lost a tile anywhere else, it would have burned through and we'd be dead.

"We should have developed an on-orbit patch kit right after STS-27, but NASA was playing Russian Roulette, hoping nothing critical would get hit, and it finally caught up with *Columbia*."

In January 1992, Gibson commanded a flight of the shuttle *Endeavour*, the program's 50th. The landing at the end of the mission was particularly satisfying. "The officially recorded touchdown sink rate was 0.0 feet per second," Gibson said; "we were almost perfectly asymptotic." Translation: despite the shuttle's perverse flight characteristics, Gibson brought *Endeavour* in for the kind of whisper-soft landing that earns airline pilots applause.

Gibson showed the same precise touch on his next shuttle mission, in which *Atlantis* was to dock with the Russian space station, Mir. Gibson was named to command the mission.

*Atlantis* launched on June 29, 1995. Once in orbit, Gibson began the delicate dance to bring the shuttle closer and closer to Mir.

"We had to make contact at .1 foot per second," said Gibson. "Much faster and we'd break something. Too slow and the latches wouldn't capture. I brought *Atlantis* in at .107."

The Mir docking mission would be his last shuttle flight. Gibson served as the shuttle program's deputy director of flight operations for a while, but "I really wanted to get back to flying," he said, and his wife wanted to move to Murfreesboro, where she'd grown up. Gibson retired from NASA and went to work flying as first officer for Southwest Airlines, a job with a reasonable commute.



DAVID LEININGER

Was it an awkward career move, for someone with a flying background as extensive as his?

"A few old captains went out of their way to show that I didn't impress them. But most couldn't have been friendlier, and then I got to be an old captain myself." In 2006, Gibson turned 60,

**Below: Gibson (front right) and crewmates about to board *Endeavour* in 1992. Below right: At the end of that mission, Gibson brought the shuttle in for a virtually perfect landing.**



NASA (2)





ERIC LONG

Opposite, top: Whipping *Riff Raff* around a pylon at the Reno races lets Gibson satisfy his need for speed. Above: During a recent visit to the National Air and Space Museum, *Air & Space* asked him to pose with models showing his range of experience, from shuttle to P-51 to 737. Right: Gibson was even checked out in a Ford Trimotor, an oldie but goodie from aviation's Golden Age.

then the age of mandatory retirement for airline pilots. Since 1984, Gibson has indulged his passion for speed by racing airplanes, a sport NASA had frowned upon as too risky. (The agency grounded him for a year in 1990 for racing. In one race, his airplane and another collided, and the other pilot was killed.) In 2004, Gibson flew his green and yellow Cassutt, an experimental home-built designed for aerobatics and pylon racing, at 237.9 mph, beating a 20-year-old record. He also set a world altitude record in it.

The Cassutt is fast, but it's *Riff Raff*, a big red and white Hawker Sea Fury that Gibson races at the Reno Air Races, that draws the crowds. At the 2007 races, Gibson clocked a blistering 437 mph—the aircraft's fastest qualifying time.

*Riff Raff*'s owner, retired physical therapist Mike Keenum, has over 10,000 hours of flight time and flies *Riff Raff* in airshows, but at Reno, he wants Gibson's hands on the stick and throttle. In races, says Keenum, "the difference between winning and losing, between life and death, is measured in split seconds. You've got to be able to think fast, decide fast, and act fast. Hooter does all those things better than anyone I know."

Our tour was over. The Museum was about to open for busi-



"LINC" DEXTER

ness as we walked outside into the windy winter air.

"When the next generation of commercial rockets for tourists is ready to test fly," Gibson said, "there'll be a line of pilots hoping for a seat." He flashed a confident smile, then added, "I'd kind of like to be at the front of it." He has already been part of one effort, signing on in 2006 as chief pilot at Benson Space Company, which did not survive the death of its founder, Jim Benson, last year.

Beyond the parking lot, we could see a 737 approach nearby Washington Dulles International Airport. "Someday that's what leaving for orbit will be like," said Gibson. "A scheduled flight in a spaceship with wings." With Hoot Gibson in the cockpit? 



**M**OST OF THE TIME we never find out what hit us. This time we did. The object now remembered as 2008 TC3 had been circling the sun for eons, on an orbit similar to Earth's, its existence unsuspected until the day before it struck. Measuring about six feet across (or maybe 12—deduced from brightness, such estimates are rough), the boulder was at the limit of detectability for ground-based telescopes that search for asteroids on a collision course with Earth. It was discovered on the morning of October 6, 2008, by the Catalina Sky Survey in Tucson, Arizona, the current pacesetter in finding near-Earth objects, having identified 565 new ones last year alone.

Catalina employees alerted the staff of the Minor Planet Center at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, who quickly plotted an orbit. By their calculations, 2008 TC3 would hit northern Sudan within 20 hours—exactly the sort of event the Catalina Sky Survey was set up to warn against. Had the object been 10 times larger, there would have been hurried calls to world leaders and a state of emergency. But rocks the size of 2008 TC3 enter the atmosphere every few months without causing harm.

Among those who took note of the impending strike was Jacob Kuiper, a meteorologist at the Royal Netherlands Meteorological Institute whose job it is to inform airlines of hazardous weather and volcanic ash clouds along their routes. Kuiper immediately realized the unique opportunity for pilots flying over eastern Africa to observe the meteor, and notified the Dutch airline KLM, which put out the word. Early on the morning of October 7, 2008 TC3 blazed into the atmosphere, and some 15 minutes later, Kuiper got a call from the airline: Two of its 747 pilots on a course from Johannesburg to Amsterdam reported several bright flashes to the northeast while flying over Chad. Captain Ron de Poorter and copilot Coen van Uden likened the flashes to artillery fire or distant lightning.

Meteors—the “shooting stars” you’re likely to see from your back yard on a moonless night—are particles the size of a grain of sand heating the air and vaporizing as they zip along at up to 40 miles per second. Bigger objects burn brighter. Those that

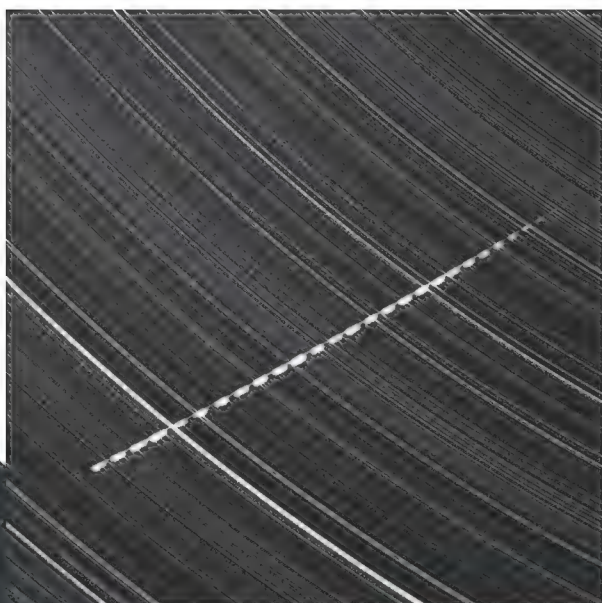
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**NOTHING GETS YOUR ATTENTION QUITE LIKE A METEOR SCREAMING IN AT 40 MILES A SECOND. by Tony Reichhardt**

# Fireball!!







PHIL BLAND/IMPERIAL COLLEGE LONDON (2)

**A humdinger of a meteor blazed over the Okie-Tex Star Party in western Oklahoma last October (left). All-sky-camera images in Australia (above) record meteor tracks – and (above right), among star tracks, Comet McNaught and an Iridium satellite.**

outshine Venus, the brightest planet, are known as fireballs, and some super fireballs are as bright as the sun.

Fireballs are memorable sights, but not all that rare, not even for pilots. On November 20, only a few weeks after the Sudan meteor, another large object fell toward Earth, this time over Saskatchewan, Canada, east of Edmonton. Among the hundreds who reported seeing the meteor was J.R. Novak, a pilot for Spec Engineering of Calgary, who saw it from his altitude of 9,000 feet as a “flaming red trail” ending in an explosion. Pilot Mark Lavoie likened it to an emergency flare.

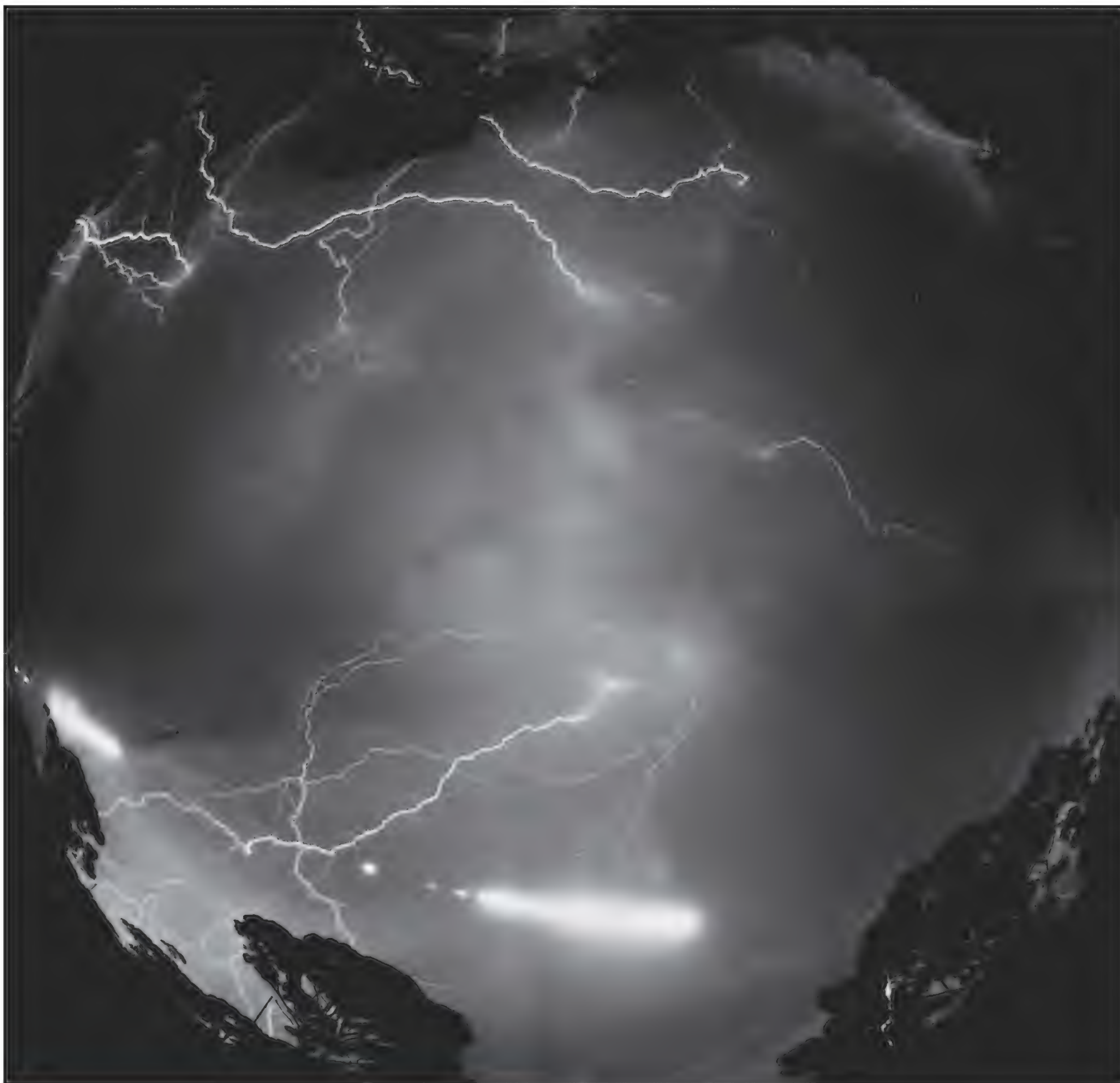
That evening, United Parcel Service pilots Mike Meyer and Paul Locraft were on their way home to Anchorage, Alaska, in an MD-11. They were at 37,000 feet near the border of Alberta and Saskatchewan when a fireball as bright as the sun appeared in their windscreen, heading away from them on a parallel course. “We went from a resting heart rate to max heart rate in about two seconds,” says Meyer. “I thought it was an airplane that had just turned on its landing light before it was going to hit us. Paul thought it was a missile.” It took them only a few seconds to realize that the bright light, already fading to red, was a meteor. But in those few seconds, says Meyer, “we both thought that was our last moment here on Earth.”

To Meyer and Locraft, it seemed that the meteor was at their altitude, about seven miles. In fact, it was between 15 and 50 miles; the pilots’ eyes were tricked by the curvature of Earth. According to Martin Beech, a meteor expert at the University of Regina in Saskatchewan, that “cruel optical effect” has frightened many a fireball witness. Fireballs always seem closer than they are, and the meteorites—the pieces that make it to Earth—land much farther away than “just over that hill,” which eye-witnesses typically report.

Harvey Nininger, the foremost meteoriticist of the early 20th century and a champion meteorite finder, stated flatly in a published paper, “It is absolutely impossible for any single observer to judge the distance of a meteor.” Maybe so, but were he alive today, he would be flabbergasted by the variety of telescopes,

HOWARD EDIN





PHIL BLAND/IMPERIAL COLLEGE LONDON

**Nullarbor Plain all-sky cameras in the Australian desert, designed to catch meteor images, record lightning and the moon in a long exposure, broken when the camera shut down to protect itself from rain.**

satellites, cameras, and other sensors that enable scientists to track incoming meteors with unprecedented accuracy.

In the 20 hours between the discovery of 2008 TC3 and its detonation over Sudan, 27 observatories tracked its orbit. When TC3 hit the atmosphere, visual and infrared sensors on the European Meteosat 8 satellite recorded the flash. So too, according to NASA's Near Earth Object office at the Jet Propulsion Laboratory in California, did unspecified U.S. government spacecraft—presumably the Defense Support Program satellites that watch for infrared signatures of ground-launched missiles.

Data from military satellites are in fact our best evidence for the actual rate of space rocks hitting the planet each year. In 2002, Peter Brown of the University of Western Ontario and colleagues published in *Nature* magazine an analysis of flashes that military satellites recorded from February 1994 to September 2002. Some 300 events were identified as probable meteors. The scientists were able to reconstruct the energy of the explosions in the atmosphere, and to extrapolate the rate of larger and smaller objects hitting Earth. By their estimate, an object with 50 kilotons of energy (the bomb that exploded over Hiroshima in 1945 yielded about 15 kilotons) appears on average every 10 years. An impact with the force of 0.33 kiloton occurs monthly. The Sudan fireball, about a kiloton, was on the lower end of the range.

Ground-based instruments are also useful in catching meteors in the act. Large bolides (another term for impactors) can



cause atmospheric pressure waves strong enough to register on seismic detectors. The first, and still largest, of these extraterrestrial seismic impact signals to be captured was caused by a June 1908 blast near the Siberian river Tunguska. Recent estimates put the blast at about 3,000 to 5,000 kilotons of energy, from an object roughly 120 feet across. A reasonable guess of the frequency of such impacts is once every few hundred to a thousand years.

As arms control agencies have set up a global network to monitor compliance with the Comprehensive Nuclear Test Ban Treaty, another tool has appeared to help meteor trackers. A meteor's dying scream falls in the "infrasound" range, below the range of human hearing. Infrasound can be "heard" with microphones tuned very low or barometers tuned very high, and instruments designed to listen for nuclear explosions pick up the low rumble of incoming space rocks as they hurtle through Earth's atmosphere.

Add to these the dedicated networks of all-sky cameras (nearly the entire sky appears in a single frame) set up in Canada, Europe, and the United States over the past 50 years to watch for bright meteors. The most recent is under construction in Australia's Nullarbor desert, a project headed by Phil Bland, a planetary scientist at Imperial College London, with colleagues from the United Kingdom and the Czech Republic. These networks provide photographs taken at different locations, which help researchers triangulate the positions of meteors, plot their paths through the atmosphere, and reconstruct their original solar orbits—like running a movie backward to see how it started.

Only nine times have scientists managed to assemble enough information from cameras, infrasound, seismic detectors, eyewitness reports, and other sources to reconstruct an impactor's original orbit. As a result, only a handful of the estimated 30,000 meteorites in collections come from known orbits.

Bland hopes that his Australian network, which consists of four cameras but is expected to grow to at least 10, will better bridge the gap between the astronomical study of asteroids and the geological study of meteorites. Bland foresees his cameras tracking a fireball so accurately that a search team will be able to find any resulting meteorites quickly, enabling a reconstruction of the original object's solar orbit. For asteroid researchers, that's like mounting a cheap sample-return mission. "Fundamentally, you need to know where that rock came from to understand it," says Bland.

An estimated 40,000 rocks heavier than a half-dollar fall to Earth every year (impactors larger than a couple of feet typically explode from the pressure of ramming through the atmosphere at high speed, dropping meteorites to the ground). Only a small percentage are ever found.

Scientists aren't the only ones interested in more efficient searches: The total haul of meteorites from a "witnessed" fall can be worth tens of thousands of dollars on the collectors' market. Meteorite hunters now know it's possible to predict fireballs.

And maybe next time they'll get more than 20 hours' notice.

In that case, says Wayne Hally, a New Jersey-based coordinator for the North American Meteor Network, "many dozens of people would get in their cars and start driving." Among them would likely be McCartney Taylor, a collector in Austin, Texas, who says that such predictions, if they become routine, will "change the meteorite business. We're going to have to pre-deploy if we're going to beat other guys to the fall."

Robert Jedicke of the University of Hawaii's Institute for Astronomy is in charge of asteroid observations for Pan-STARRS, a new telescope network headquartered in Hawaii that will provide fast, frequent sky surveys. Pan-STARRS will outperform today's asteroid searches, but, says Jedicke, finding objects as small as 2008 TC3 on a collision course with Earth is "not going to be something that happens all the time. It's a very rare occurrence. We're going to need bigger telescopes covering much more of the sky on a regular basis."

Bigger survey telescopes are planned. Clark Chapman, who studies asteroids at the Southwest Research Institute in Boulder, Colorado, predicts that by the 2020s, the next generation of asteroid surveys will have tracked a quarter-million orbiting objects 16 feet in diameter—not much bigger than 2008 TC3.

For now, though, the Sudan meteor remains unique: the first object ever tracked from space all the way to its demise in the atmosphere. Robert Haag of Tucson, Arizona, the self-proclaimed "Meteorite Man," knows that for this reason alone any meteorites it dropped would be valuable—if he could only get to them. The trouble is, they fell on the edge of Darfur, one of the most dangerous places on the planet. A University of Khartoum team has since reported finding meteorites, but at the time of our talk in December, Haag doesn't know their location. And he's mulling over his chances of getting there first. In fact, even as we talk, he's got Google Maps up on his computer screen, scouting for train stations near where 2008 TC3 fell. —

**McCartney Taylor photographed a lone rock in Lone Rock, Saskatchewan, Canada. His Web site, [texasmeteoritelab.com](http://texasmeteoritelab.com), offers searchers \$100 per pound of meteorite.**



McCartney Taylor, Texas Meteorite Laboratory





# The War

## Between the Wars

IN THE SKIES OVER SPAIN, PILOTS AND AIRPLANES  
REHEARSED FOR WORLD WAR II.

BY CARL POSEY ILLUSTRATIONS BY HARRY WHITVER



# A

**AT THE CUATRO VIENTOS AIRPORT** on the outskirts of Madrid, a small party has gathered at the Infante de Orleans foundation's aviation museum to celebrate a new design by a local watchmaker. The timepiece is named *Mosca*, for a Russian-built fighter that flew in the Spanish Civil War 70 years ago. Later that day the watch will be presented to the airplane's most famous pilot, José María Bravo Fernández-Hermosa.

On this fine autumn Saturday, both man and machine are here. As he often does on such occasions, José Bravo poses for photographs beside the olive-drab *Mosca*, which wears his old aircraft number, CM-249, and the *seis doble*—the double-six domino tile—painted on its vertical stabilizer.

The veteran ace absorbs the attention with the ease of a rock star. Affable and a bit frail at 91, he likes an arm to hang onto while the cameras flash, but it's no stretch to imagine him in this muscular little airplane. Still wearing a lapel miniature of his red-star wings, he is one of a handful of living fliers who were present when World War I met World War II in Spanish skies.

Bravo's war began in July 1936, when much of the Spanish army, led by a junta of generals, rebelled against a newly elected popular front government, a volatile coalition of liberals, communists, workers, anarchists, and separatists. The army-backed Nationalist side comprised fascists and their blue-shirted counterparts in the Falange party, along with monarchists, the aristocracy, and the Catholic Church.

Fearing a European war or a Russian-style revolution, the League of Nations decided against intervention, leaving the new Spanish government to defend itself and both sides to wage war with limited

military means, particularly when it came to aviation. The Republican government's air force was a creaking assemblage of the old and slow. And even though the Nationalists controlled the army, their air force was virtually nonexistent.

Both sides also suffered a dearth of pilots, but most of the veteran military pilots remained true to the army and quickly sided with the rebels. Joaquín García-Morato Castaño, for example, was already one of Spain's most accomplished pilots when the war began. At 32, he had accumulated 1,860 hours and flown against Moroccan insurgents. Fighting on the Nationalist side, he would lead the potent *Patrulla Azul* (Blue Patrol) and emerge as the conflict's top ace, with 40 confirmed kills.

Only a few pilots stayed with the government. If the Republicans wanted an air force, they would have to create it from a legion of young men who had never left the ground.

First, though, both sides turned to outsiders for help. Despite their official neutrality, Hitler's Germany and Mussolini's Italy both quickly came to the aid of the fascist-leaning rebels. Italy supplied a dozen Savoia Marchetti SM.81 trimotors. Manned exclusively by Italian crews, the low-wing Savoia transports spent the war doubling as bombers. The first German "package," code-named Magic Fire, was on its way within weeks of the war's start. Twenty Junkers Ju 52/3m transports arrived by ship, along with half a dozen Heinkel He 51 fighter-bombers and tons of spares, ammunition, and anti-aircraft weaponry. Nearly 100 German airmen were also on board as "vacationers."

By early August, the Ju 52s had flown 1,500 veteran troops from Spain's Army of Africa to the mainland in history's first major military airlift. With them came General Francisco Franco, who set up headquarters in Seville. Over the next few weeks, the Junkers and Savoias brought another 20,000 or so air force personnel from Africa, past the Mediterranean naval blockade. Franco emerged as leader of the Nationalist rebellion, but not of Hitler's air forces. The latter were quickly placed under German command, constituting a mini-Luftwaffe in Spain: the Condor Legion.

"None of us knew that the German Volunteer Corps in Spain went by that name," Luftwaffe ace Adolph Galland would write in *The First and the Last*. "We only noticed that one or another of our comrades vanished suddenly into thin air...and that after about six months he returned, sunburnt and in high spirits."

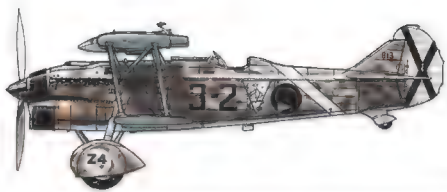
**"Today more than ever, VICTORY" was the rallying cry on a Republican government poster (opposite) produced in 1938. But the Nationalist rebels held better cards, including veteran pilots like Ángel Salas Larrazábal (below, seated at center), who finished the war with 17 kills.**



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OPPOSITE: PHOTO ILLUSTRATION: TED LOPEZ, POSTER: UCSD MANDEVILLE SPECIAL COLLECTIONS LIBRARY





Italy's Fiat CR.32, called the *Chirri*, was agile in combat.

Galland became a Condor Legion legend, flying in swimming trunks, a cigar clamped in his teeth, his face blackened by gun smoke and engine oil. Leading the Mickey Mouse squadron (named for its pistol-toting rodent insignia), he honed the ground-attack abilities of the He 51. He developed carpet bombing to flush miners from caves in the northern province of Asturias, and, with his mechanic, brewed up a bomb called the *flambo*—a precursor to napalm.

Italy's air corps in Spain was known as *la Aviazione Legionaria*. With the Italian pilots came more trimotor bombers, along with Meridionali Ro.37 ground-attack biplanes. Italy's main gift, however, was the highly maneuverable, potently armed Fiat CR.32, which in Spain was called the *Chirri*.



Tupolev's fast, streamlined SB-2 bomber went by the nickname *Katyushka* — "Little Kate."

Help came to the Republican side as well. Josef Stalin agreed to provide men and matériel, although not entirely for love. Airplanes were available at retail prices, to be paid in Spanish gold. By mid-October the Soviet Union shipped 30 SB-2 *Katyushka* (Little Kate) fast bombers. Designed by Andrei Tupolev, they were smooth-skinned, with a low cantilevered wing and two big Wright-Cyclone-type radial engines. These



CARL POSEY

were joined by the agile Polikarpov I-15 *Chaika* (Seagull, for its gull-like upper wing), which the Spanish would call *Chato* (Snub-nose), and Polikarpov R-5s and R-Zs, which were used for reconnaissance and light bombing.

Then, in early November, Spain received the first Polikarpov I-16 monoplanes. In an age of two-wingers, this speedy fighter had a single, low, cantilevered metal wing and retractable landing gear, plus a 1,000-horsepower radial engine up front. The I-16 was called *Yastrebov* (Hawk) and, at home, *Ishak* (Little Donkey). In Spain it was called *Mosca* (Fly) by its friends, *Rata* (Rat) by its enemies. By any name, the I-16 was at the time of its debut the most advanced fighter ever sent into combat.



NASM (SI 8012995)





LEFT: CARL POSEY; RIGHT: ANTONIO CAMARASA

Soviet volunteer pilots came over even before the airplanes arrived, and soon were given Spanish *noms de guerre*. Yakov Smushkevich became General Douglas, Colonel Pyotr Punpur became Colonel Julio, fighter group commander Pavel Rychagov, Pablo, and so on. By late November, 300 Soviet pilots were flying for the Republican side, which, having lost the early air war, soon fought back to reclaim the sky over Madrid.

Volunteers from other countries also flocked to the Republican cause. Eager to fight against the fascist rebels, the French writer André Malraux came over with a gaggle of lumbering Potez Po.540 twin-engine bombers—famously, “flying coffins.” Although he never piloted an airplane, Malraux survived more than 60 missions. But his involvement in the war was short-lived. By January 1937 the flamboyant polymath was gone, and more than half of the several dozen Po.540s sent by France had been destroyed.

The first American volunteers arrived in late September 1936, followed by another contingent in November, and a third near the end of the year. Ideology was less important to this group than it had been to Malraux’s. Most thought the cause was okay, and \$1,500 a month and \$1,000 for every Nationalist airplane destroyed was good money. Ben Leider, the *New York Post* “flying reporter,” was the only Communist, and the only one working for regular officer’s wages, like his Russian and Spanish counterparts. Not long after his arrival, he was killed by CR.32s from Morato’s *Patrulla Azul*.

The American volunteers were better at aviation than at life. Frank Tinker, whose memoir, *Some Still Live*, would make him briefly famous, was typical: Annapolis graduate cashiered from the Navy for bad behavior, traveling on a passport issued to one “Francisco Gomez Trejo” (who, unaccountably, spoke no Spanish). Tinker’s fellow volunteers included aviators of fortune, barnstormers, bootleggers, and thieves. But Tinker, the aw-shucks Arkansan with a taste for drink, women, fighting, and flying, became the mercenaries’ historian.

He flew for the *Escuadrilla de Chatos*, commanded

by Andrés García Lacalle, who, at the age of 27, had already downed 11 Nationalist aircraft. Lacalle organized his unit into three “patrols” of four aircraft each, with Tinker and three other Americans known as *La Patrulla Americana*. In early February 1937, the squadron moved to a field near Guadalajara, northeast of Madrid. There the Americans got their first look at the Russian I-16. Failing to recognize the new face of aerial warfare, Tinker thought the aircraft was a knockoff of the Boeing P-26 Peashooter.

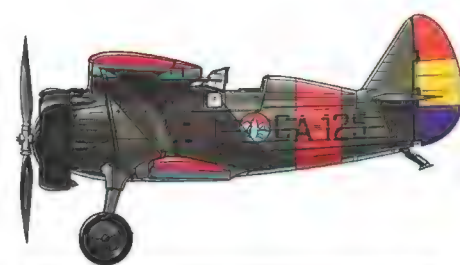
Guadalajara was the scene of the Republican pilots’ finest moment. In early March 1937, word came that a massive Italian force was advancing on the city. Harold “Whitey” Dahl, another American, took his *Chato* up into the soggy weather on an armed reconnaissance mission. Tempting the Italians with a low pass, he discovered they were paralyzed by flooded roads and washed-out bridges, and had little anti-aircraft defense.

As soon as the rain let up, Lacalle scrambled his *Chatos*, each aircraft laden with 18-pound bombs. Dropping under the low ceiling, the squadron found and attacked the Italians. It was the only unit on either side flying that day, for the rains had turned most airfields into bogs. Lacalle’s had been planted in alfalfa, which kept it usable.

As the weather lifted, scores of Republican fighters and bombers attacked the Italians again. With staggering losses of men and matériel, the advance stalled. It was the first time in history that air power had stopped a major ground offensive.

Between fights, the pilots could enjoy hot baths and an endless party at Madrid’s Hotel Florida, where

**José Bravo (above left) and his *Mosca* (shown flying over the Infante de Orleans foundation museum in 2008; opposite: the museum’s sign). Opposite, bottom: Both sides liked cartoon characters, like the one on this Republican *Chato*.**



**The Polikarpov I-15, or *Chato*, was a mainstay for Republican pilots.**



**The I-16 *Mosca* was the world’s best fighter at the time of its debut.**



they befriended Ernest Hemingway and other journalists. Hemingway's short story "Night Before Battle" has a pilot called Baldy who is modeled on Dahl.

But even as the Republican aviators seized the initiative, the era of volunteers was winding down. Tinker and another American, A.J. Baumler, moved to a Soviet *Mosca* unit. Before the summer ended, they would head home.

The Republicans would fight most of the air war with brand-new Spanish pilots, trained in Russia.

**AT THE BARCELONA OFFICES** of the Association of Republican Aviators, or ADAR, the walls are decorated with posters, maps, and black-and-white photos of pilots and airplanes—most of them long gone. The shelves are lined with wooden models of Spanish Civil War aircraft. The association's insignia, the red star and wings, is everywhere.

The walls also bear color photographs of an early ADAR reunion, held at Cuatro Vientos in 1972.

The association began during the last years of Francisco Franco's dictatorship, with clandestine meetings of former Republican airmen. The members still get together annually, and the organization now includes non-combatants.

"The reunions are important," says Marie Carmen Martin, who runs the office. "They bring people together from around the world to meet and to help one another." Like many in the ADAR community, she is a veteran once removed: Her father was a Re-

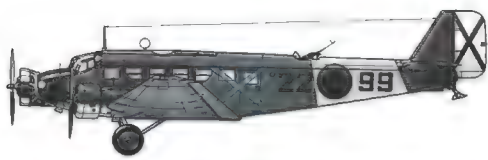
publican aviator. "It's my family," she says. "My life." The organization lives on contributions, receiving no government support for its activities.

Each year there are fewer members who can recall arriving in the Azerbaijani city of Kirovabad in January 1937 as part of the first "expedition" of young Spanish men selected for flight training in Russia. One who remembers is José Bravo. "We put on Soviet uniforms," he wrote in 2007. "Our mission was ultra-secret and no one was to know that they were bringing in Spaniards. They gave all of us Russian names. I was Iosif Bravi."

After six months of training (starting in the docile Polikarpov U-2 biplane), Bravo had logged about 100 hours, only a few in the I-16. Back in Spain by summer, the new aviators went to high-speed school, then, still relatively green, to a Soviet *Mosca* squadron in the north, and combat. The Russian and Spanish pilots stood alerts beside their fighters on grass fields, waiting for the flares that signaled a scramble. After a few times around the field, said Bravo, "We'd head off to look for the enemy."

By then the enemy was easy to find: Swarms of next-generation German warplanes had entered the fight. The bitter winter battle of Teruel, in the mountainous region of Aragon, was the most savage combat of the war. In January 1938, Republican forces were nearly destroyed by a Nationalist counter-attack. Casualties on both sides ran to the thousands, with devastating losses in the air.

In the ADAR office's main room, Gregorio Gutiérrez García sits at a large table. Now 91, he was part of the second expedition to the Soviet Union, going



**The Junkers Ju 52** ferried troops in history's first major military airlift.



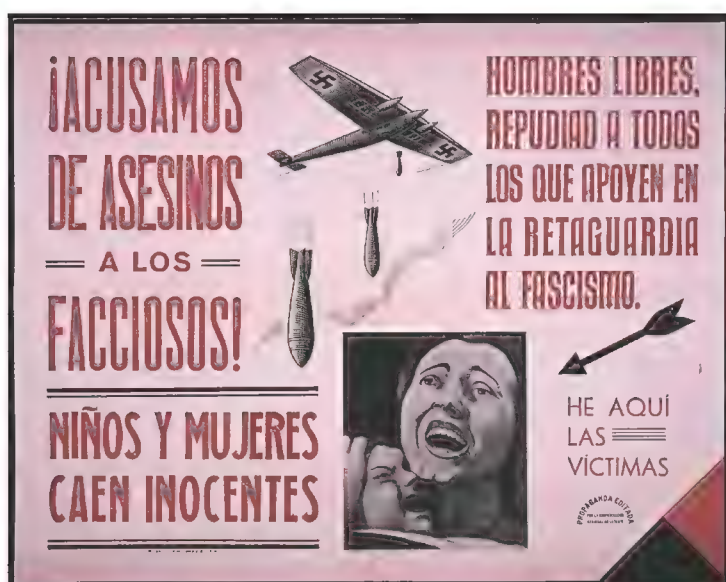
**The Heinkel He 51** started out as a fighter, but was later used for ground attack.

The German-built Junkers Ju 52 transport was a game-changer for the Nationalist rebels, ferrying thousands of Spanish army troops from north Africa to the battlefields of Spain. One of its nicknames was "Iron Annie."



COURTESY FRANCISCO VALERO





over in late 1937. At the Spanish airman's school in Kirovabad he was Gutin Gregoriev, or "Guti." He returned to Spain in mid-1938.

Before going to the Soviet Union, he had fought on the Madrid front with the International Brigade. Did that mean he was political?

He shakes his head emphatically. "The first expedition was political. The second was not. I did not take part in communism."

Joaquín Calvo Diago comes in, very thin in a blue suit and sweater, his skull evident beneath the skin. He has a huge grin and his memory is crystal clear. He was in the same expedition as Gutiérrez, but went to *Chatos*, not *Katyushkas*. He was called Yokuv Calvin.

Was Calvo political?

He makes a face and shrugs. "I was a kid. I knew nothing." But he liked the training. "Three months at the Soviet school was better than three years in the Spanish one."

Guti and Calvo joined the fight in late summer 1938, and by the end of that year, not a single Russian pilot remained in Spain. "When we were ready, all the Soviet pilots went home," Calvo says. "Italians had complete units, Germans also. But by now the Republican pilots were all Spanish."

With the Republicans still reeling from the disaster at Teruel, Franco launched an offensive aimed at slicing off Catalonia, on the French border, from the rest of the country. All of the Condor Legion's Heinkel He 111s, Dornier Do 17s, and Heinkel He 51s were dedicated to the attack, along with something new: the Junkers Ju 87 Stuka dive-bomber, in combat for the first time.

Republican forces were driven southward along the Ebro River. A daring counterattack beginning in July 1938, staged with little protection from enemy aircraft, lasted bravely for four months before ending in defeat. It was the government's last major offensive against the fascist rebels.

Calvo, who came to lead the Republican fighter forces, still feels fond of the little biplane that got him through the war: "The *Chato* is simpático"—nice. "The *Mosca*," and his hands pretend to haul back on a heavy



LEFT: UCSB MANDEVILLE SPECIAL COLLECTIONS LIBRARY; RIGHT: IMAGNO/GETTY IMAGES

wheel, "very hard; stronger." The *Chato*—more hand gestures—"was very maneuverable against the 109 [the Messerschmitt Bf 109]. It climbed well." His *Chato* hand moves around behind his Messerschmitt hand and takes an imaginary bite. Another big grin.

Gutiérrez prefers his beloved *Katyushka*. In a remembrance for the ADAR publication *Icaro*, he described the life of a bomber crew in the final days of the war. "The fourth *escuadrilla* of *Katyushkas* was active on every front, Teruel, Segre, Extremadura, Levante, and, of course, the Ebro. We flew almost daily, often in the morning and afternoon, without break," he wrote. Over Catalonia, "[t]he air space we had to cross was a veritable curtain of smoke and fire.... To penetrate this space, one needed well-tempered nerves. To get out...the only thing you needed was *baraka*...luck."

The *Katyushka* carried a crew of three—pilot, observer, and gunner—and had machine guns above and underneath the aft fuselage. The gunner could use both, but not at the same time; when he was on the upper gun, the *Katyushka's* underside was unprotected.

**The bombing of the Basque city of Guernica by German and Italian pilots on April 26, 1937, shocked the world and presaged a new era of strategic bombing of civilian populations. Above left: A contemporary poster reads, "We charge the rebels as murderers!"**



Introduced in 1935, the Heinkel He 111 bomber (right) was one of the Condor Legion's most potent weapons. Bottom: The Republican stronghold of Barcelona after a March 17, 1938 German and Italian bombing raid.



NASM (SI 9A 0087)

During a September 2 raid in the western province of Extremadura, one of the three-airplane patrols in Guti's harried *Katyushka* squadron became separated. Smelling opportunity, a Nationalist Fiat CR.32 dropped into position behind the bombers and took them down, one-two-three. By the time the *Mosca* escorts saw what was happening, the *Katyushka* crews had bailed out, only to be shot as



So lumbering was the French-built Potez Po.540 that it was nicknamed "the flying coffin."

they floated to Earth, or gunned down on the ground. "Besides the powerful enemy," Gutiérrez wrote, "we also had another inside the house. When we flew any mission, we had to examine the parachutes, which were almost always sabotaged. The espionage

service had information on everything. When we left, they knew in advance the date, hour, altitude...even what we had for breakfast."

What kind of targets did he hit?

Guti replies forcefully: "I never bombed a city." He doesn't need to elaborate: The German and Italian pilots' bombing of the Basque city of Guernica on April 26, 1937, remains the air war's most infamous act, immortalized by a Pablo Picasso painting. Only once, says Gutiérrez, did Republican bombers hit a concentration of *guardia civil*, holed up in Avila. "The Germans always sent their planes against civilians. Also the Italians."

**JOSÉ BRAVO'S CIVIL WAR** ended at Vilajuiga on February 5, 1939, 10 days after the fall of Barcelona and less than two months before the Republican surrender. The plan was to take the *Chatos* and *Moscas* that could still fly and head for France. Bravo still has the letter authorizing the pilots to abandon Spain.

Some *Chatos* took off the following dawn. Then German bombers, escorted by Bf 109s, attacked the field. Bravo narrowly escaped his burning *Mosca*, but all his documents, including his flight log, were lost.

After the bombers rumbled away, a single "Messer" remained, staging an aerobatic show while strafing. Something—Bravo thought it must be ground fire—hit the German fighter, which fell out of a loop and plowed into the ground.

Another pilot, Francisco Tarazona, wrote a vivid account of what followed: "From the wreck of the downed Messerschmitt...the German pilot staggers away.... Wisps of smoke issue from his flying suit....



NASM (SI 9A 00089)



‘Kill me!’ he cries.... Arias [another *Mosca* pilot] gets his pistol out.

“‘What are you going to do?’ roars Bravo.

“‘Kill him! To put an end to his suffering,’” Arias replies, cocking his pistol.

“‘No! Let the bastard rot.’”

As they move away, Arias suddenly turns back. “He points the barrel of his pistol at the poor man’s eyes, then fires one shot between them.”

With no airplanes to fly, Bravo and his companions crossed the Pyrenees on foot. They were captured and interned in a camp at Gurs, just over the border in France. “The French tried to enlist some of the hundred or so pilots into their colonial army,” recalled Bravo, who refused. “Better to be the last of the Republicans.”

When the Soviet Union offered the pilots a Russian future, however, most were quick to accept. But Fernando Medina was among those who escaped and returned to Spain to await his fate. The crews were told that their aircraft were to be handed over to the Nationalist victors at Barajas, Madrid’s major airport. On March 29, nine *Katyushkas* took off from the Republican base at San Clemente, along with six more from Tarazona, 12 *Chatos*, and a score of *Natashas* (Polikarpov R-5s).

“We landed in Barajas in the early hours of the morning,” Medina would recall. “We were ordered to form up and remove our flying gear, including our leather jackets. All our equipment was shared out among their soldiers.”

The next day, the aircrews were taken to the prison at Porlier. “I was tried and sentenced to death in Valencia on August 25, 1939,” said Medina. “For seven months I waited for the sentence to be carried out. Seven months of watching comrades and friends pass on their way to their execution.”

In the offices at ADAR, Calvo crosses his wrists in pantomime. “At 20, I am in handcuffs.” He nods playfully at Guti, who is slightly stouter. “The reason he is healthy is he was eating,” Calvo says, hands moving over an imaginary bowl, “while I...” He imitates working a pick at hard labor.

José Bravo got another war. When Hitler invaded the Soviet Union in June 1941, Bravo and other Spanish airmen living in Russia served as partisans until a chance encounter with a former Soviet boss put them back in fighters. The last airplane Bravo flew was a Bell P-39 Airacobra, in 1948.

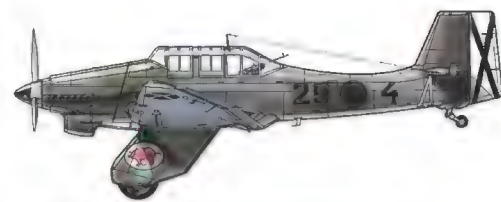
In the mid-1950s, Spanish exiles began returning to their homeland, through a program of repatriation arranged by the International Red Cross. Bravo returned in 1960, and was promptly interrogated about Soviet military facilities (the cold war had made Franco an ally of the West) put under surveillance, and allowed to work only as a language professor and translator.

“When Franco died” in 1975, Gutiérrez says, “the

government let us reclaim our rights.” He is listed on the Spanish air force rolls as a retired *comandante*. Calvo and Bravo are retired air force colonels. Largely because of the efforts of these men to win recognition for their accomplishments, Spain now recognizes the ranks and pensions of all Republican veterans.

As for the victors, the German Condor Legion went home in May 1939, followed by the Italians. Germany would invade Poland in September, a month after cutting a non-aggression deal with Stalin. In the war that followed, Luftwaffe pilots would refine the tactics they had introduced in the skies over Spain.

But the “Stuka mentality”—the belief that one could dive-bomb and blitz the enemy into submission—proved a fatal delusion. Germany continued to rely on medium bombers, having used them successfully in Spain. The Germans had no armadas of long-range B-17s and Lancasters in the next world war, so there were no British Dresdens or Hamburgs. Ironically, the Condor Legion’s Spanish victories helped sow the seeds of Hitler’s ultimate defeat. ➔



**The Junkers Ju 87 Stuka dive bomber saw its first combat in Spain.**

**A few months into the war, in the Basque town of Elgoibar, a crowd watches rebel aircraft overhead.**



FPG/HULTON ARCHIVE/GETTY IMAGES



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# HIT ME WITH YOUR BEST SHOT

**A dozen tips for great airshow photos.** by Caroline Sheen

**YOU DON'T NEED A LENS AS LONG AS YOUR ARM** to get memorable – and artistic – shots at an airshow. The five professionals whose photographs appear on these pages will tell you that all the equipment in the world won't deliver wonderful pictures if you don't have patience, imagination, and a good eye. What may help are a few trade secrets. As the *Air & Space* photo editor, I've looked at thousands of airshow pictures – and shot a few myself – and the ones that always stand out are shot by photographers who have fresh ideas and don't settle for the tried and true.



When Steve Oliver and his nocturnal Chipmunk flashed the audience at Florida's Sun 'n Fun airshow last spring, Richard VanderMeulen caught the sparks from the ground. Dragging along lots of equipment can sometimes cause you to miss a shot, but if you want to bring one long lens for faraway subjects, make it a 300- to 500-mm.





RICHARD VANDERMEULEN (3)

**Anticipate.** Learn the performers' routines, listen to the announcer, and be ready to trip the shutter at the right moment, as Richard VanderMeulen was when he froze the MiG-17 (above) just as the nose-wheel left the ground, and caught stuntman Andy Roso (right) just as he grabbed the ladder to climb into the Super Cub. Check out the speed that VanderMeulen evokes by panning his camera with the MiG. Want to try it? Set a slow shutter speed and follow the aircraft. The result: a photo of fast—the airplane in focus, the background blurred. But for pure drama (opposite), wait for spectacular nighttime aerobatics.



At the Oshkosh, Wisconsin airshow (top), a MiG-17 lets it rip. Above: Pilot Kyle Franklin flies his inaugural motorcycle-airplane transfer.





PAUL BOWEN



## The chance for air-to-air is rare,

but an offer to buy the gas can sometimes earn a ride. If you do get the opportunity to fly on a photoship, heed the words of air-to-air master Paul Bowen. He says that (1) the photographer is only as good as the pilots, so make sure they are qualified to fly formation; and (2) the preflight briefing is key. Listen as the pilots confer, and when it's your turn, explain your goal for the shoot: how you hope to arrange the aircraft, what you'd like to see in the background. To get a full propeller arc (like the ones in the photo on the opposite page), Bowen says to try a shutter speed of 1/60 of a second. But use your air-

**A lush landscape punches up the color of twin aerobats in Paul Bowen's shot: Greg Poe flies an MX2 (background) and Evan Fagen is in the Extra 300L.**

borne time wisely: As you fly to a site, make test shots, checking various exposures and settings. Whatever exposure you use, be sure to take advantage

of the bird's-eye view. Groundlings can get an airplane with sky behind it; when you're up there, get the good Earth in the frame.

## Show up at small fly-ins, where

the people are friendly and the mood is laid back.

That's where you can interact with pilots, learn something about their airplanes, and get the most intimate candids of owners with their treasures. (The little fly-

in is also your best bet for an air-to-air hop.) I like to position myself strategically near interesting aircraft, and wait for the fans to show up. People interacting with aircraft adds energy to an other-

**Fan magnets, like Frank Schelling's classic Jenny (below, at the Antique Aircraft Association's Iowa fly-in), reward patience. Bottom: Larry Tobin wipes down his prize 1927 Stearman.**

wise static photo. Try to capture something of the setting, which seems to increase in loveliness as the airshow crowd decreases in size.



CAROLINE SHEEN (2)



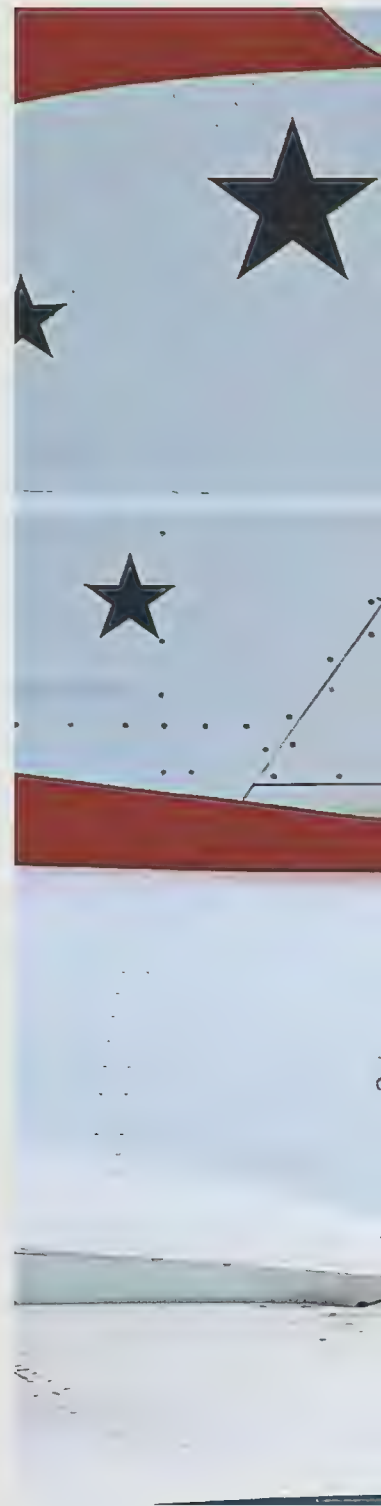
**Experiment.** A single airplane shouldn't fill every frame; focus now and then on details. Look for strong geometric shapes, symmetry, patterns, and repetition. Arnold Greenwell captured the concept of precision by zooming in on the F-16 vertical stabilizers in the Thunderbirds' lineup (right). Also, vary your perspective: Get up high and look down, or get on your belly and aim up.

**Light is magic.** It can transform an average scene into art. The light's color, direction, degree of contrast, and amount of diffusion all can

Shot as the sun spilled across the ramp at the Reno Air Races, a Navy SNB-5 looks lonely but heroic in Arnold Greenwell's painterly photo.

change the mood and impact of a photograph. Look for reflections in polished aluminum (below). Professional photographers love dawn and

dusk because of the soft light and strong shadows, so get up early and hang out late.







ARNOLD GREENWELL (4)



The U.S. Air Force Thunderbirds in inaction (above). Airshows bring out World War II reenactors (left). To make a current shot look vintage, copy Greenwell's trick: Print color in sepia tone.





Bill Stein (above) waves at fans after a performance in his Zivko Edge. Using a flashlight as a paint brush, Tyson Rininger illuminated a Mustang trainer and gave it an underglow for an artful night shot at the 2007 gathering of Mustangs in Columbus, Ohio.





*Make your shot.* Everybody brings photographs back from an airshow. Photos can be perfectly framed, exposed, and focused, and still be perfectly uninspired. I've seen hundreds of pictures of the Blue Angels, for example, framed in a square of bright blue sky. Tyson Rininger knew better than to put his camera away when the clouds came out, and his backlit shot of the Blues mixed with smoke and cloud (above) is a winner, shot from the ground.

**At Abbotsford Airshow in British Columbia (above), the Blue Angels turn on the smoke.**

Use composition to create impact. The airshow performer in focus and waving is much more effective when the crowd forms a glimmering backdrop (left). Paint with light by dragging the beam from a flashlight over key areas of an airplane (opposite) while your tripod-mounted camera is set for a long exposure. Finally, for a shot that combines a little bit of everything—anticipation, composition, originality—turn the page.





Dude. No way you can outrun that. Blue Angels crew chief Amani Brown steps lively at the 2007 California International Air Show in Salinas.



# Then & Now

FROZEN MOMENTS AS TIME MARCHES ON

## Under Stress

**WHEN IT CAME TO** testing the integrity of aircraft wings, early builders didn't have many choices. On fabric and wood wings, they piled sand—loosed or bagged—to see how much weight could be borne. For sturdier wings, they had workers stand on the wing to determine stress limits.

"It's all they could do. There was a lot of guesswork then," says Howard Wolko, a retired special assistant at the National Air and Space Museum and an authority on the history of aircraft structure. "They basically tested it until it broke."

It wasn't until 1920, when Donald Douglas set up his own aircraft company, that wing stress tests began to advance. Douglas, one of the first designers with an aeronautical engineering degree from the

**Airbus bends an A380 wing more than 24 feet in Toulouse, France, in 2006. Just before reaching its target of 1.5 times the stress limit, the wing broke.**

Massachusetts Institute of Technology, brought a key tool to the process: mathematics. "That's when reasonable

structural analysis techniques began to be used," says John Anderson, curator of aerodynamics at the Museum. "Douglas carried with him from MIT modern techniques for stress calculation, all done on a slide rule."

With the invention of the strain gauge in 1938, a wing's structural integrity could be verified without having to flex the entire wing. Strain gauge measurements were then adopted for use in U.S. military aircraft development during World War II.

Strain gauges are still used today to verify the accuracy of computer analytical models that drive the design and manufacture of a wing. Boeing, which is building the 787 Dreamliner,



**At the R.E.P. factory in Buc, France, around 1911, workers test the strength of a monoplane wing by inverting it and filling it with sand.**

uses computers to analyze 9,000 actuator-induced stress points on the aircraft, including 2,000 on each wing.

"As you push up on a wing, our analysis says it ought to deflect a certain amount, so we measure [with strain gauges] the amount it actually deflects," says Mark Jenks, vice president of development for the 787. "The basis of [federal] certification is analysis supported by test."

Last November, Boeing tested to destruction a full-scale composite wing box, a beam that carries the wing to the fuselage and that supports the control surfaces, engines, and landing gear. To meet federal certification, the wings must withstand loads up to 1.5 times what the jet could expect to see in its roughly 20-year lifetime. The 50-foot-long wing box, half the span of an actual 787 wing, withstood the load.

Boeing will do two static tests to measure wing stress before the Dreamliner's first test flight this year; structural fatigue tests also are planned to begin. Though Boeing has a long history testing metal-wing aircraft like the 777 and earlier models, with the all-composite 787, says Jenks, "we're lower on the learning curve" so more testing is in order.

PAUL HOVERSTEN

LEFT: AIRBUS; ABOVE: NASM (SI-2001-11613)



# Sightings

PICTURES WORTH A SECOND LOOK

**THEY STOOD UP** to the harsh lunar environment, but the suits that protected the 12 Apollo moonwalkers between 1969 and 1972 have suffered from decades of heat, humidity, and ultraviolet light on Earth. “We needed to know how degraded they were, but there’s no way you can see inside a spacesuit,” says Amanda Young, the National Air and Space Museum’s curator of early astronaut equipment. So, last summer, Young teamed with colleagues Ron Cunningham and Carl Bobrow at the Smithsonian’s Paul E. Garber storage facility in Suitland, Maryland, and X-rayed Alan Shepard’s Apollo 14 suit (right). The team laid it on 30 film plates and positioned an X-ray device about 10 feet overhead for this first-ever X-ray of a full suit. From beneath the outer layer of fireproof, Teflon-coated fiberglass, called Beta cloth, a maze of innards emerged. “Wires, cables, tubes, pipes, God knows what else,” says Young. For instance, the X-rays revealed a rectangular patch of Chromel-R, a steel fabric with a high chromium content, across the upper back (seen overlapped by the neck ring). The patch kept the 100-pound life support unit from wearing through the suit. The X-rays also revealed hardening of the rubber convolute in the sleeves, hips, and thighs, and deterioration of internal air hoses. The team X-rayed Harrison Schmitt’s Apollo 17 helmet, an overshoe, and a glove (opposite), all of which took on a simplistic, ghostly beauty. Young’s inspection of these images revealed degradation of rubber inside the glove.













The X-ray photographs appear in *Spacesuits*, a book by Young that will be published in June. The book fleshes out the history and engineering of humanity's most complex garment, and includes photographs by Mark Avino of most of the suits in the National Air and Space Museum collection.

One of those suits was a blue, full-pressure A5-L prototype from 1966 (below left), made by ILC Industries of Dover, Delaware, which supplied all the moonsuits. With helmet, Beta cloth shell, and portable life support unit, the ensemble weighed a little less than 200 pounds on Earth, a sixth of that on the moon. Still, it offered improved mobility over earlier suits, such as a 1964

prototype of a full-pressure Apollo suit (opposite), its silvery cover layer designed for thermal testing. The A5-L was light-years ahead of a 1965 Litton Industries RX-3 prototype (below right), which looked like it came right out of a 1950s science fiction movie. The RX-3 was made for the U.S. Air Force's canceled Manned Orbiting Laboratory Program. Young and Avino's book focuses on the Apollo spacesuits.

"They're so fragile now," says Young. "They deteriorate not because of what they did, but because of what they are." Thanks to these images, she has made one small step for curators eager to preserve the evidence of the first human steps on another world.





# Reviews & Previews

BOOKS, MOVIES, CDs, STUFF TO BUY

## Flying With the Enemy

A secret U.S. Air Force program had American fighter pilots mixing it up with Soviet-built MiGs in the skies over Nevada.

### *Red Eagles: America's Secret MiGs*

by Steve Davies. Osprey Publishing, 2008. 352 pp., \$25.95.

#### BACK IN THE LATE

1970s, during the cold war between the United States and the Soviet Union, rumors abounded that somehow, the U.S. Air Force had acquired examples of Soviet-built MiG fighters, and that it was wringing them out to learn their secrets.

The rumors were true: In 1968, the Air Force became the temporary custodian of a Mikoyan-Gurevich MiG-21 Israel had received courtesy of a defecting Iraqi pilot. Out of that modest beginning sprang what became an ambitious, covert effort that enabled the Air Force to acquire numerous Soviet fighters, including the MiG-17, -19, -21, and -23.

By 1976, Air Force pilots had quite a bit of experience flying early MiG fighters, and the service was about to embark on a bold new program: acquiring MiGs to



use as training tools for U.S. fighter pilots. The Tactical Air Command's 4477th Test and Evaluation Squadron,

based at Tonopah, Nevada, was home to a group of fighter pilots known as the Red Eagles. They not only flew MiG-17s, MiG-21s, and swing-wing MiG-23s, they flew them like Soviet

and Warsaw Pact fighter pilots would, so Air Force, Navy, and Marine Corps fighter and attack crews could get experience flying against the Other Team.

For years snippets of information about the Red

**Pilots who wore the 4477th Test and Evaluation Squadron patch (right) made their living flying MiG-17 (above, leading) and MiG-21 (trailing) fighters (in formation with two F-5s).**

Eagles' classified training flights leaked out, the result of people talking too much and journalists tenaciously following a good story. Then the MiGs themselves started showing up in museums, delivered with no explanations and little documentation (the National Air and Space Museum has one, a MiG-21). In late 2006, the Air Force declassified much



of the cloak-and-dagger story of the 4477th Test and Evaluation Squadron, but Steve Davies' impressively researched *Red Eagles: America's Secret MiGs* goes well beyond what the government chose to release. Taking advantage of the fact that many program participants spoke freely regardless of program security guidelines, Davies has woven an intricately detailed and remarkably thorough account of the 4477th.

The Red Eagles' training



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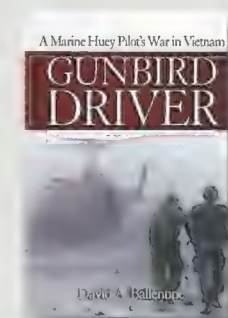
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flights satisfied more than idle curiosity. Combat between opposing aircraft in the era of air-to-air missiles is a deadly winner-take-all business. The remorseless air war over North Vietnam revealed a serious problem for U.S. pilots: When they first spotted a closing MiG, they often let their gaze linger as they took in the aircraft's unfamiliar lines, allowing the adversary to gain positional advantage. During the Red Eagles training program, U.S. fighter pilots got used to seeing MiGs in the air and started responding to them as they would to any other aggressor aircraft they encountered. The program worked. One veteran Air Force fighter pilot once told me, "You looked, saw a MiG, and thought 'No big deal, I can handle that.'"



### Gunbird Driver: A Marine Huey Pilot's War in Vietnam

by David A. Ballentine. Naval Institute Press, 2008. 236 pp., \$28.95.

This memoir details a young pilot's experiences flying a UH-1E helicopter with Marine Observation Squadron Six.

### Hypersonic Thunder

by Walter J. Boyne. Forge, 2009. 352 pp., \$26.95.


Boyne, former director of the National Air and Space Museum and the founder of *Air & Space/Smithsonian*, has written a novel set amid aerospace developments from 1973 to 2007, mixing fictional characters with such real-life pilots as Howard Hughes and the late Steve Fossett.



The fighter pilots who dominated Iraqi MiG-21 and MiG-23s in the Gulf War of 1991 were, for the most part, pilots who, thanks to the 4477th, had first encountered them in American, not Middle Eastern, skies. But their success came at a price. Two Red Eagle pilots were killed

during the secret program: Navy pilot Hugh Brown never made it out of a spinning MiG-17 and Air Force pilot Mark Postai died ejecting from a MiG-23. Davies' *Red Eagles* is a fitting tribute to them, and to all those who flew and supported the MiG training effort. His is a wonderful

tale, superbly told, unveiling one of the last great unknown cold war stories.

 RICHARD P. HALLION IS AN AEROSPACE HISTORIAN AND ANALYST WHO RETIRED IN 2006 FROM THE U.S. AIR FORCE'S DIRECTORATE FOR SECURITY, COUNTERINTELLIGENCE, AND SPECIAL PROGRAMS OVERSIGHT.

## >>> Out of The Vault <<<

### The High and the Mighty: Collector's Edition

DVD. Not rated. Paramount Home Video, 2005. \$19.99.

**WELCOME TO TOPAC** Airlines DC-4 service from Honolulu to San Francisco. Now boarding 22 passengers – with lots of baggage.

Viewed a half-century later, William Wellman's 1954 film of Ernest Gann's novel is a tribute to commercial aviation's glamorous renaissance following World War II. It's also a flashback to an era of redemptive storylines with improbably colorful characters.

Nobody captured aviation like Bill Wellman, director of the 1927 classic *Wings*. Filmed in widescreen Cinemascope, his air-to-air shots of the DC-4 plying cloudscapes to swelling theme


music are stunning. Faithful interiors reveal a lost world of wide, comfy recliners and unpressurized ambience. A navigator takes transoceanic fixes with a sextant and a star; on the ground, chattering teletypes and wall-sized aeronautical charts track air traffic before radar.

In *The High and the Mighty*, when an engine fails, ditching looms. Aging first officer John Wayne wrests control from nerve-racked Robert Stack. There's no mistaking this pair for US Airways' Chesley Sullenberger and Jeff Skiles, particularly when Duke slaps his captain out of a panic attack. But Wayne commands like, well, John Wayne, and Stack's rigidly detached pilot persona convinces

(he'll spoof it 25 years later in *Airplane!*).

Cockpit suspense and dwindling altitude are juxtaposed with the passengers' clichéd backstories. The racy-yet-vulnerable blonde bombshell, en route to marry her mystery penpal. The boozy, conflicted atomic scientist with thermonuclear secrets in his carry-on. Stewardess, Dramamine please.

Gann's characterizations feel '50s-lite, but Wellman's rich visuals still satisfy. *The High and the Mighty* freezes a frame of postwar, pre-Jet-Set aviation, when the romance and future of airline travel seemed as unlimited as the Cinemascope sky.

 STEPHEN JOINER WRITES ABOUT AVIATION FROM LOS ANGELES.





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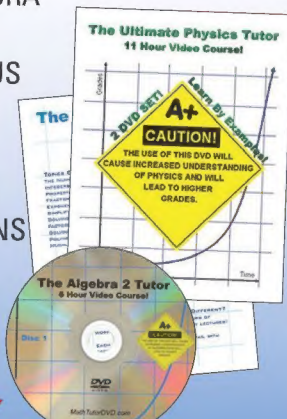
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## IN THE NEXT ISSUE

### The Billy Mitchell Court Martial

Courtroom sketches from what was, for aviators, the trial of the century.

### Future Fantastic

Pint-size unmanned vehicles flitting around U.S. airspace? Havoc! cries the Federal Aviation Administration. Progress! say their users.

### Driving Mr. Churchill

When the British PM needed a lift, the special delivery was made by American pilot William Vanderkloot and his B-24 Liberator crew.

### Fast Times in Strategic Air Command

Former National Air and Space Museum director Walter Boyne remembers Curtis LeMay, weapons tests, and flying the B-47 bomber.

### Attack of the Phantom Airships!

In 1909, Britons were convinced that the Kaiser's spies were about to launch a Zeppelin invasion.

### Step Outside

A photo history of the spacewalks that led to that one giant leap.

**Take a walk on the wild side: Pierre Thuot riding the end of *Endeavour's* robot arm.**



NASA



## Credits

**My Enemy, My Friend.** Dan Cherry served with the U.S. Air Force for 29 years, during which he commanded the Eighth Tactical Fighter Wing and the Thunderbirds, and flew 295 combat missions during the Vietnam War. He retired with the rank of brigadier general. To purchase his just-published book, send a check for \$25 to Aviation Heritage Park, My Enemy My Friend, P.O. Box 1526, Bowling Green, KY 42102-1526.

**Homage.** Peter M. Cleland, a flight instructor at the Stick & Rudder Flying Club at Illinois' Waukegan Regional Airport, has been teaching people to fly since 1981.

**Is It Safe?** Michael Milstein is a frequent contributor to *Air & Space/Smithsonian*.

**Zoom Shot.** Contributor Stephen Joiner writes about aviation from Southern California.

**Restoration: Beech Staggerwing.** Mark Huber has written about the old, the odd, and the obtuse for *Air & Space* since 2000.

**Shoulder to Shoulder.** Rafael Lima is a writer and documentary video producer based in Coral Gables, Florida.

**The Man Who's Flown Everything.** Robin White is the author of eight novels and two nonfiction books. A



"...and note, it also has a spellchecker."

new book, on business in a post-petroleum world, is due out this fall.

**Fireball!** *Air & Space* senior editor Tony Reichhardt wrote about the search for Apollo artifacts on the moon (Aug./Sept. 2008). He's never seen a fireball, but if a meteorite lands anywhere near his home in Fredericksburg, Virginia, he'll be among the first to jump in his car and go looking.

**The War Between the Wars.** Longtime contributor Carl Posey writes from Alexandria, Virginia.

**Hit Me With Your Best Shot.** Caroline Sheen is the *Air & Space* photography and illustrations editor.

**Under Stress.** Paul Hoversten is the *Air & Space* executive editor. His last feature was about Amelia Earhart ("An American Obsession," June/July 2007).

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## The Hungry City

**BEFORE THERE WERE RAILROADS,** cities were built on rivers; when the railroads came, cities sprang up along them. The reason for these patterns is that the life's blood of cities—the goods that feed, clothe, and house the citizens—enter via ships, trains, and now trucks. And the daily diet of a city is measured in thousands of tons of freight per day.

After World War II, the city of Berlin, the capital of a defeated Germany, was divided for administrative purposes among Germany's conquerors: Britain, France, the Soviet Union, and the United States. As it happened, the Soviet zone encircled the entire city of Berlin. When the Soviets took umbrage at a decision to introduce a new currency into Germany, they decided to blockade Berlin by barring all surface traffic to and from the city. Soviet leader Josef Stalin thought the blockade would strangle Berlin and force the other three Allied powers to abandon it.

However, part of the postwar partitioning agreement had delineated three 20-mile-wide air routes connecting Berlin to Rhein-Main and other airports in western Germany, well beyond Soviet influence, so the other Allies decided to attempt to replace the blocked surface routes with an airlift. It began as a British idea, and it started small. It fell to the Douglas C-47 Skytrain, a militarized DC-3 rated for a combat load of less than four tons, to haul the freight for two million Berliners. Had Stalin done the math, he'd have undoubtedly figured the airlift would fail: The city needed a daily total input of food, coal, and sundries requiring a thousand sorties a day—one C-47 flight every 90 seconds, 24 hours a day, seven days a week.

Enter the four-engine Douglas C-54 Skymaster, capable of hauling 10 tons with ease. The daily tonnage numbers rose dramatically, but the Skymaster, designed for long-legged missions, suffered mightily from the brutal regimen of short hops at maximum weight. And it took a while to get a maintenance support infrastructure, including spare parts, emplaced in Europe to keep the big airplanes in repair. British aircraft contributed enormously to the effort, and soon the whole fleet was carrying enough tonnage to meet the city's needs. On one mid-April day in 1949, the aircraft hauled 13,000 tons, setting a standing record for the airlift.

When winter came, the need for coal to heat homes and buildings added to the airlifters' burden. Europe's typical bad weather brought low visibility, but an approach system using precision radar, called ground control approach, or GCA, provided landing guidance. With airplanes arriving every few minutes, controllers

literally talked each one in along a path aligned with the runway's centerline and a vertical approach slope. In pitch-dark radar shacks, controllers murmured corrections: "Drifting left...correcting...slightly above glide path..." on some occasions bringing in an aircraft in zero visibility. Pilots flew a compass heading and the rate-of-descent indicator. When the airplane was within seconds of landing, the controller advised the pilot to "acknowledge no further transmissions" and stepped up the tempo of corrections until the aircraft was safely on the ground.

Sixty years ago this year, the Soviets finally gave in. All the blockade had accomplished was to showcase Western resolve and airpower. And you can't blame Stalin for failing to anticipate the Berlin Airlift. No air freight operation on such a scale had ever been attempted before. In the end, the Allies had delivered 2.3 million tons to Berlin on more than 278,000 flights.

■ ■ ■ GEORGE C. LARSON, MEMBER, NAA



**Operation Vittles was a military miracle: The Allies delivered 2.3 million tons of supplies to Berlin.**

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